

AN
E S S A Y
ON THE
MOST EFFECTUAL MEANS OF PRESERVING
THE
HEALTH OF SEAMEN
IN THE ROYAL NAVY.
AND
A DISSERTATION
ON
FEVERS AND INFECTION.

Together with
Observations on the JAIL DISTEMPER, and the
proper Methods of preventing and stopping its Infection.

By JAMES LIND, M.D.

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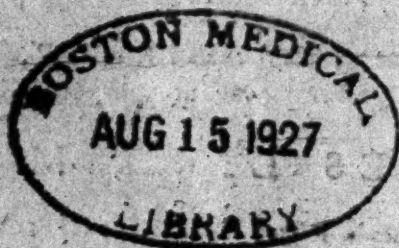
A NEW EDITION, much enlarged and improved.

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P R E F A C E.

THIS Volume contains two distinct Publications, an *Essay on the most effectual Means of preserving the Health of Seamen*, and a *Dissertation on Fevers and Infection*; which, as they serve to illustrate each other, are now reprinted together.

That particular parts of the work might more readily be consulted, it is divided into Chapters and Sections; and the whole is rendered more distinct by some alterations in the Arrangement.

The *Essay on preserving the Health of Seamen* is now, in a Third Edition, presented to the Public with

iv P R E F A C E.

several Alterations, which, in Course of Time, have become necessary, and a new Chapter on the *Means of obtaining fresh Water at Sea*, is added, in which the Author vindicates his Claim to the important Discovery of freshening Sea-water by Distillation.

The *Dissertation on Fevers and Infection* has also been before published, but now appears with large Additions, and a plain and practical Application of the whole to the *Jail Distemper*, the late alarming State of which in most of the Jails in England calls for Attention.

C O N-

CONTENTS.

CHAP. I.

Means of preventing Sickness from being introduced into a Ship or Fleet.

SECT. I.

Of Imprest Men.

FRESH Provisions and greens necessary for seamen impressed on their return from foreign Voyages. Precautions to be taken with impressed landmen to avoid the jail distemper. A ship to be appropriated for receiving persons suspected of infection. An uniform proposed for the royal navy. On the appearance of sickness, in vessels with impressed men, the sick to be sent on shore; the remaining crew and vessel purified. First signs of an infection; its mildness often the reason of its being disregarded; Danger of concealing it. General regulations necessary in crowded ships.

p. 1

SECT. II.

Of Draughting Men.

Small ships proper to inure landmen to a sea-life. Large ships on foreign voyages to be recruited from frigates, and with seasoned seamen.

11

a SECT.

S E C T. III.

Diseases in Northern Climates.

Of suppressed perspiration. The use of eschallot, garlic, and onions, recommended. A mixture of brandy and beer fermented with melasses, preferable to issuing either beer or spirits alone. Flannel under-jackets necessary in winter. A constant supply of fresh provisions and greens proposed for fleets cruising in the Channel. Garlic brandy recommended.

p. 15

S E C T. IV.

Unwholsomeness of new-built Ships.

Dangerous vapour exhaling from new timbers; its effects; methods of obviating them. New ships improper for long and sickly voyages. Impropriety of washing the decks after sun-set.

23

S E C T. V.

Directions in Southern Voyages.

Usual Diet to be changed. Allowance of salt meat to be diminished.

26

S E C T. VI.

Necessaries for the Sick.

Portable soup, new baked bread, wine, rob, or juice of oranges and lemons; cream of tartar recommended.

31

S E C T. VII.

Method of obtaining Vegetables at Sea.

Means of preserving greens, pot-herbs, &c. fresh for a considerable time. Method of raising a sallad at sea.

39

S E C T.

C O N T E N T S.

vii

S E C T. VIII.

Accidents frequent in Ships.

Treatment of persons under extreme intoxication. Means of recovering such as are supposed to be drowned; suffocated by the noxious vapour from a ship's well; or struck by lightning. p. 42

S E C T. IX.

Preservatives of Health on board Ships.

Ventilators, exercise, cleanliness, and the cold bath recommended. 48

S E C T. X.

Diseases in Southern Climates.

Impropriety of indiscriminate bleeding by way of prevention. Danger of crowding ships with men. Epidemic fever of hot climates, its cure, and method of prevention. 51

S E C T. XI.

Precautions necessary in Southern Climates.

Ships during the unhealthy season to be anchored at a distance from swamps. The night air to be avoided. Means of defending ships from the noxious land-breezes. The men employed in wooding and watering, not to sleep on shore. Rules for such as are obliged to sleep on shore; a well-thatched hut, smoak, and a bark bitter recommended. Account of an extraordinary and unwholesome vapour met with in Guinea. 65

S E C T. XII.

Means of removing the Land-sickness.

Sickness from the land air removed by the ship putting to sea. Articles of restorative diet, necessary for the sick. Of contagion in a ship. 85

a 2

S E C T.

S E C T. XIII.

Means of procuring wholesome Water at Sea.

Important discovery of rendering sea-water fresh by distillation. General benefits resulting from this discovery. Various methods of purifying bad water. p. 88

S E C T. XIV.

Claim to the Discovery of freshening Sea-water.

The author's claim to the original discovery of freshening sea-water by simple distillation. Account of Dr. Poissoniere's having received a pension in France, and Mr. Irving a reward of 5000 l. in England from parliament, for the discovery, several years after it had been published by the author. State of the discovery when Mr. Irving began his experiments: his mode of distilling the water, by a large tin tube, wet with mops: his certificates and publications: a comment upon them: inutility of his proposed alteration. 97

C H A P. II.

Means of stopping the Progress of contagious Diseases when introduced into a Ship.

S E C T. I.

Apartment for the Sick.

Ventilation, and a free circulation of air, beneficial. A place to be allotted for the sick under the fore-castle, or in the gun-room, in infectious diseases. Regulations necessary for keeping the sick apartments clean. Patients on recovery to be separated from the sick. Infected bedding to be destroyed. Arrangement of the sick. 131

S E C T.

C O N T E N T S. ix

S E C T. II.

Preservatives against Infections.

Approved method of purifying the air in general during infection. Necessary precautions for the security of the attendants on the sick. p. 142

S E C T. III.

Of Hospitals.

In cases of infection information of it to be sent to the hospital, before the sick are landed. Caution necessary in receiving men from hospitals during a general infection. Separate wards to be allotted for different diseases. Tents in the open fields recommended for the sick during a strong contagion. Conclusion. 150

A P P E N D I X.

Cautions with respect to bleeding in hot climates. 157

Comparative degrees of heat and cold in different latitudes. 163

Cases of 5743 seamen received in two years at Haslar hospital. 170

Prescriptions adapted to most of the diseases incident to seamen. 173

x C O N T E N T S.

DISSERTATION on FEVERS and INFECTION,

C H A P. I.

Cases of Infection in 1758, 1759, and 1760. General
Means of purifying infected Places and Substances.

S E C T. I.

State of Infection in 1758, and 1759.

*State of infection in the fleets at Spithead, in the years
1758, and 1759.* p. 185

S E C T. II.

Fevers produced by Infection.

*Observations on the yellow and spotted fever; remarkable in-
stances of infection.* 209

S E C T. III.

State of Infection in the year 1760.

*State of infection at Spithead in the year 1760. Instances
of persons labouring under infectious diseases on board of
ship without communicating the infection. Remarkable
long state of health enjoyed by the grand fleet, under Sir
Edward Hawke, on the coast of France.* 210

S E C T. IV.

Properties of Infection.

*Healthfulness of the sea-air. Difference in fevers arising
from infection; the sick themselves less apt to communicate
infection than their apparel: substances to which it most
strongly adheres. Malignity of the fever proportionable
to the virulence of the infection. Ventilation not always
sufficient to remove infection.* 218

S E C T.

C O N T E N T S. xi

S E C T. V.

Means of removing Infection.

Means of removing infection. Infection destroyed by smoke.

Means of purifying ships, when the men are removed, by burning tobacco, brimstone, arsenic. Means of purifying places, when the sick cannot be removed, by wood-fires, smoke of gunpowder, scent of burnt cascarilla, steams of camphorated vinegar, fresh air. Means of purifying infected cloaths, &c. their immediate exposition to the air improper, previous fumigation necessary. Caution in washing them. p. 226

C H A P. II.

Means of obviating Infection received into the Body. Treatment of infectious Fevers.

S E C T. I.

Of Infection.

Infection difficult to be controverted by negative proofs. Excretions of the sick most liable to communicate the disease. Treatment of infected persons. Degrees and symptoms of infection; its exciting causes, remedies. Means used to preserve the attendants at Haslar hospital. 238

S E C T. II.

Of Fevers.

Of febrifuge medicines: antimony; contrayerva and Virginia snake-root; opium; tranquil state of body and mind. The common appellations of fever unsatisfactory: noxious vapours from the earth a frequent cause of fevers: study of different fevers recommended. 258

S E C T. III.

Of Fevers.

*Description of Petechiæ in fevers. Prognostics in fevers.
Weak state of the body after a fever. Restoratives. p. 270*

S E C T. IV.

Dissections.—Of the blood.

*Appearances after fevers on dissection. Component parts of
the blood; its gluten. Various modes of morbid extrava-
sation. Conjecture on the purulent state of the blood in
fevers. 279*

S E C T. V.

Of Infection.

*Infection frequent in families, boarding-schools, and places
unsuspected. Opinions concerning its existence in different
fevers. Fatal consequences of too rashly denying its exist-
ence. Abstruse nature of infection. 289*

C H A P. III.

Of Infection.

*Various symptoms proceeding from infection of the malignant
sore throat, its prevention. Remedies against the plague.
Bad symptoms in fevers. 299*

C H A P. IV.

*Of the Jail Distemper, with the Means of putting a
Stop to it, or any other contagious Disease.*

S E C T. I.

Of the Jail Distemper.

*Universality of the jail infection: mistakes concerning it;
it is not always attended with an highly malignant fever;
is*

C O N T E N T S. xiii

is not always general in a prison ; may be communicated by a person in health from tainted cloaths : does not reside in air. p. 306

S E C T. II.

Of the Jail Distemper.

Origin of the Jail Infection unknown ; its source ; is diffused by air as a vehicle ; its properties in common with the plague and small pox ; small distance to which its influence extends ; its self-extinction ; method of destroying it in infected places and substances. 315

S E C T. III.

Remarkable Instances of Infection:

General influence of the jail distemper : its similarity to the epidemic, purple, and scarlet fevers : frequent instances of it in the French fleet : a dreadful infection at Brest. 323

E C T. IV.

Of Prisons.

Means to prevent infection, applied to prisons, to prevent its being generated ; free air necessary, proper arrangement of doors and windows, wind-stoves, wind sail ; plenty of water necessary ; no furniture to be kept which can imbibe infection : to prevent its being carried into prisons, a large oven, a bathing-room necessary : to remove it from prisons ; prisoners to be carried to another jail ; fumigations. When prisoners cannot be carried out, separation to be made between the healthy and sick. Prisoners occasionally to be moved, and the evacuated cells fumigated, the infected cloaths to be purified by fire, by fumigations ; degree of heat necessary to destroy infection.

330

S E C T. V.

Of Courts of Judicature.

Means of checking infection in its infancy, applied to courts of judicature : to prevent infection being carried into court,

court, clean dresses proposed for prisoners at the bar, a canvas frock insufficient, court rooms to be well aired: precautions when prisoners are introduced in their infected cloaths: personal preservatives against infection; different modes by which infection can be received; means of obviating it when received into the body: recapitulation of the necessities for prisons and courts to avoid infection. p. 341

S E C T. VI.

Method of stopping Contagious Diseases.

Method of stopping an infection when universally diffused; danger of indiscriminately shutting up whole families; the healthy to be shut up; the dispersed sick to be collected into one place; arrangement of infected patients; opinion of infected patients when collected together being prejudicial to each other refuted: plan of regulations drawn up for suppressing an infection in a Russian fleet, when at Spit-head: difficulty of distinguishing infectious fevers: benefit of pure air in fevers.

349

A N
E S S A Y
O N T H E
M O S T E F F E C T U A L M E A N S
O F P R E S E R V I N G T H E
H E A L T H O F S E A M E N,
I N T H E
R O Y A L N A V Y.
T H E T H I R D E D I T I O N.

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To the Right Honourable
GEORGE LORD EDGCUMBE.

MY LORD,

I Beg Leave to prefix your Lordship's Name, as the most proper Introduction to this ESSAY; by exhibiting a Pattern of that humane Disposition, which is requisite to put in Practice the Rules contained in the following Pages.—A Disposition not less honourable to your Lordship, than beneficial to the Public; and which, added to many other amiable Qualities, rendered you esteemed by your Officers, beloved by your Men, and respected by all, who felt the happy Influence of your Command.

That,

xviii DEDICATION.

That, in the Royal Navy, so laudable an Example may become the Object of universal Imitation, is the sincere Wish of,

MY LORD,

Your Lordship's most obedient,

and most humble Servant,

JAMES LIND.

ADVERTISEMENT.

THIS book was first published in the year 1757, soon after the commencement of a war with France, as a plan of directions for preserving the British seamen from such distempers as prove much more fatal to their *Corps*, than all the other calamities incident to them at sea. For the number of seamen in time of war, who die by shipwreck, capture, famine, fire, or sword, are but inconsiderable, in respect of such as are *destroyed* by the ship diseases, and by the usual maladies of intemperate climates.

In the year 1762, a second edition of it was published, by authority of the Lords Commissioners of the Admiralty: an honour which their lordships were pleased to confer upon account of the important discovery I had then made, of rendering sea-water perfectly fresh and wholesome by a simple distillation.

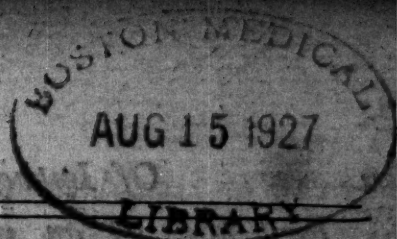
The Abbé Mascas has translated this Essay into French, and it appears there was an order given by the French king that

that it should be distributed to both the Indies, and to all the maritime parts of his dominions; and a translation of it into the German language was published at Copenhagen by Dr. Lange.

Dr. Wind, an eminent physician in Middleburgh, has translated it into Dutch, with the addition of some judicious notes.

My public acknowledgments are also due to Dr. Moncky, physician at Amsterdam, for the honourable mention he has made of my name in his treatise, which obtained the Dutch premium as the best answer to the question proposed by the Society of Sciences in Holland, relative to the diseases of seamen in voyages to the West Indies.

THE



AN
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ON THE
Most effectual Means of preserving
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CHAP. I.
Means of preventing Sickness from being
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SECT. I.
Of Imprest Men.

*Fresh provisions and greens necessary for sea-
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First signs of an infection; its mildness often the reason of its being disregarded; Danger of concealing it. General regulations necessary in crowded ships.

IN times of public tranquillity, when only smaller ships of war are employed, and are manned with sound and seasoned sailors, when their voyages are short, and sufficient opportunity is allowed to refresh in harbour, the seamen in his majesty's service are, in general, healthy. A ship of fifty or sixty guns commonly buries fewer men, in three years, than most villages in *England*, containing a like number of inhabitants; except in a few accidental cases, as when a ship on the coast of *Guinea*, or in the *West Indies*, suffers by any extraordinary efforts of sickness, derived from causes hereafter specified. But circumstances widely differ in the turbulent state of war, or when any emergency requires the immediate equipment of a large fleet, and renders the impressing of men absolutely necessary.

In the equipment of a fleet there are two sorts of men from whom sickness may be apprehended, *viz.* Sailors impressed after a long voyage from the *East* or *West-Indies*, or the *Coast of Guinea*; and such idle Fellows as are picked from the streets or the prisons.

The former are often deeply tainted with the scurvy and other disorders, which usually break out upon a long confinement and fatigue at sea. The constitution might, in this case, by proper care, be surprisngly soon restored, and the men duly prepared for another voyage.

From the latter set of men, there is danger of communicating infection to the whole fleet. That there is a disease of a contagious nature, the produce of filth, rags, poverty, and a polluted air, which subsists always in a greater or less degree in crowded prisons, and in nasty, low, damp, unventilated habitations loaded with putrid animal steams, is now well known, and has been too often fatally experienced, by taking such persons into our ships.

With deference then to better qualified judges, I would beg leave to suggest, what appears to be the proper method to be taken to secure the future health of the impress sailors, and to obviate the mischiefs which might accrue from diseased landmen.

In the usual descriptions of impress men taken by the regulating captains, it would be proper to insert their former way of life, the place of their late residence, their present state of health; and, with regard to sailors, the length and healthfulness of their last voyage. If, in consequence of

this report, those who are just arrived from a long and sickly voyage, were directly allowed fresh provisions, and especially a quantity of greens, a diet of this sort continued for at least three weeks, would, in all probability, sufficiently cleanse and restore their constitution, and fit them for immediate service*.

A different method may be necessary to be taken with *imprest Landmen*. A guardship is usually stationed at the *Nore*, to receive those who are taken up in *London*. But experience has shewn how fatal she has often proved to the health and lives of many seamen; and that this ship has become a seminary of contagion to the whole fleet. One diseased person from the street, or cloaths from a prison, have often conveyed infection on board, which it has been extremely difficult afterwards to remove. For the confined and corrupted air in a large crowded ship, greatly favours the spreading of this contagion, and the exertion of its utmost malignity. From this source, the environs of *Portsmouth*, *Gosport* and *Plymouth*, have more than once been annoyed with an almost pestilential contagion, which certain regulations might, in all probability have effectually prevented.

* When this book was first published, the fleet was not so plentifully supplied with fresh meat, as at present.

This has hitherto been the most fatal and general cause of sickness in the royal navy, especially on the first fitting out of the ships. In the commencement of the late war, the seeds of infection were carried from the guardships into our squadrons, to all quarters of the world, and particularly to *North America*, by the large fleets which sailed thither: and the mortality, thence occasioned, was greater than by all other diseases or means of death put together, extending itself to some thousand seamen.

After the receiving guard-ships were repeatedly purified, by the most proper orders and methods for that purpose, fresh draughts of impress men still continued the infection, in opposition to all the care taken by the officers, and their utmost vigilance and attention to keep these ships sweet, well aired, and clean: nor could it be otherwise; for the purest air cannot cleanse rags from contagion. I have known a thousand men confined together in one guard-ship, some hundreds of whom had neither a bed, nor so much as a change of linen; I have seen many of these brought into *Havlar* hospital, in the same cloaths and shirts they had on, when pressed several months before. In this case, it was impossible to prevent the generation or progress of disease. The fa-

tal mischief lurked in their tainted apparel, and rags; and by these was conveyed into other ships. A late instance is sufficiently known, where the polluted cloaths of prisoners, brought from *Newgate*, and other unclean places, have infected and destroyed the judges on the bench, and others, in an open court: and still greater danger may be apprehended from such sources of infection in a ship.

The most effectual preservative against this infection, during a press, would, perhaps, be to appoint a ship for receiving all ragged and suspected persons, before they are admitted into the receiving guardship. This ship should be furnished with flops, shirts, bedding, and all the necessary articles of seamen's apparel; with soap, tubs, and proper conveniences for bathing, and with a room upon deck for fumigating of clothes. Every suspected person, whether impressed at sea, or on shore, should be first put on board of her; their stay in her, however, should be short, as soon as they are stripped of their rags, well washed and cleaned, they should be supplied with new cloaths and bedding, and be sent on board the receiving guardships. Such of their apparel as appears tolerably good ought to be cleaned, or, if necessary, fumigated with brimstone and returned to them; but it will be absolutely

lutely necessary to destroy all filthy rags, and all such clothes as are brought from *Newgate* or other prisons.

If the captains of the guard ships were to order a supply of bedding, and such seamen's cloaths as are commonly called *Slops*, to all such imprest and transferred men as were in want of them, it is said, they would encumber their ship-books so much with *Slop* articles, as to render it difficult for them to pass their accounts. For obviating these difficulties, and averting in future equipments, during a warm press, the danger that is to be apprehended, I shall further suggest, that, if the seamen in his majesty's service were put into an uniform sea-habit, with some little moveable badges, or variations, (if judged necessary) by which it might be known to what ship they belong; each man would at first go clean and neatly cloathed on board his majesty's ships; and by the proper care of the officers, in frequently inspecting their apparel, be kept so constantly: and all the inconveniences of serving *Slops*, and the abuse of some seamen in selling and destroying them, might, perhaps, be effectually prevented.

When a tender arrives, with imprest men, at the *Nore*, from any part of *Great Britain* or *Ireland*, who, having been long

confined, under close-shut *Hatchways**, during bad weather, or in summer, may be supposed to have suffered by the polluted air, the sick ought immediately to be sent to an hospital, and the rest of the men to the store-ship, in order to be cleaned and supplied with slops. If the vessel is also infected it ought to be purified, as described in Chap. II.

Two circumstances tend greatly to encrease the mortality of this infection, viz. an ignorance at first of its true nature, and the endeavours of the officers afterwards to conceal it. Many entertain a very false opinion of the disease which this infection produces, and suppose there can be no infection unless attended by a raging malignant fever: but that is far from being the case, the first symptoms of an infection are generally mild, and may be easily mistaken for common chills, a cold, or the fit of an ague; among a number of impressed man, many will be found to complain of *shiverings*, some with pains of the breast and cough, others with head-ach and severe pains of the limbs, attended with a low fever, great thirst, and disagreeable heat of the skin; in such a case there is always reason

* The openings or doors by which they descend from one deck or floor of a ship to another.

strongly

strongly to suspect a beginning infection, which, in time, will be attended with more violent symptoms.

The concealment of the infection, when it has already appeared in a ship, serves also greatly to encrease its mortality, not only by preventing the proper means for stopping it from being used, lest they should give suspicion of its existence, but also by permitting the new draughts of healthy men, sent on board to complete the complement, to become an additional prey to the disease. It proceeds much from the blame too often thrown on the officers in cases of infection, on a supposition that it entirely proceeds from not keeping the ship clean, than which nothing can be more absurd, as an unknown person may bring an infection on board, which the utmost vigilance of the officer cannot remove. It will therefore be proper, immediately on discovering an infection, to use every method to prevent its further progress, as from inattention to it, in an early stage, it may soon become so virulent as to elude the proper means of stopping it.

In time of war, from the exigency of the service, the guard-ships become often excessively crowded with prest and transferred men. At this season, the officers must be particularly careful in the
article

article of cleanliness in the ship. For this purpose, the cloaths of the men ought frequently to be inspected, to prevent their selling of them; and thereby reducing themselves to all the inconveniencies attending the want of a sufficient quantity of clean apparel: nakedness, sloth, and filth greatly contributing to the production of diseases. The men and *hammocks* * ought every morning, in fair weather, to be sent upon deck, when the gun-ports should be opened, and the lower decks well scraped and washed; mean while such a number of hammocks should be scrubbed and cleaned, that every hammock in the ship may have undergone this operation at least once a month. In bad or moist weather, the lower decks must only be scraped and swept. When the weather will permit, fires of dried wood must be used between decks, lighted in iron kettles, or large tubs, filled partly with shot and sand. The burning wood may be occasionally sprinkled with some resin, or pieces of rope, dipt in pitch and tar. These fires must be carried into all parts of the ship, that safety will permit; I mean, the *berths* †

* The hanging beds of seamen.

† A term used at sea for the place where the men eat and sleep.

of the men. During the continuance of rainy, moist weather, the ship ought, twice a day to be fumigated with the steam of pitch or tar, raised by a hot iron; and, upon the return of good weather, be thoroughly cleansed, as above directed, with the addition of having the beams, &c. where the men lie, washed with warm vinegar. Nor must this important direction be omitted, that the air, both by night and day, be renewed by the incessant working of the ventilators.—By such methods duly practised, not only guardships, crowded with men, but all other ships, will probably continue healthy.

S E C T. II.

Of Draughting Men.

Small ships proper to inure landmen to a sea-life. Large ships on foreign voyages to be recruited from frigates, and with seasoned seamen.

AS raw sailors, and unseasoned marines, are often the occasion of great sickness in fleets, during their long cruises and voyages, I must beg leave further to suggest—That the draughting of men for particular services, if it can be done, could not fail of having a good effect in the service.

vice. The rank of the captain, and the present fitness of the ship, are not always the chief things to be considered; as the condition of a ship's company, who are to be sent upon a distant expedition, is a circumstance which must influence, in a great measure, the success of the voyage.

We observe a just distinction made in the army between veterans, and new-raised levies. But the change of life, from the civil to the military, is not so great, nor so affecting to the constitution, as a change to the sea-life. If volunteer-landmen, and new-raised marines, were at first incorporated with seamen, on board armed vessels, tenders, and small ships of war only, they would both become good sailors in a shorter time, and would gradually acquire a stronger constitution, fitted for the marine duty, without running the risk of sickness at first, or of laziness afterwards, from want of exercise; these small and well-aired ships being always the most healthy, and most employed. Whereas, on the contrary, it is observable, that large ships, on first fitting out, especially the capital ones, are more liable to sickness, even when lying at *Spithead*, or in harbour; so that the draughts made into them, should be of seasoned healthy men from other ships,
and

and of such landmen as have been somewhat inured to the sea.

If it be said, that the large ships, when manned with a seasoned crew, are observed to be very healthy; yet there is more caution seemingly requisite to prevent sickness being introduced among so great a number of men, than in ships of a smaller complement.

When a squadron is fitted out for a long and unhealthy voyage, no method would, perhaps, promise greater security than to make draughts chiefly of such men, from the smaller frigates, as had been for some time healthy and seasoned to the sea; including in these, as many as offer of such sailors as had been accustomed to the climate. This I am obliged to take notice of, as a very different method is often followed. When there is choice of men, the captains generally prefer the most able-bodied raw young fellows. But it has been evinced, by fatal experience, that such vigorous constitutions are most liable to be cut off by violent fevers in hot climates; nothing is more common than for such ships to lose their best men. Whereas many hardened veteran sailors are sometimes to be met with, who enjoy a better state of health in the *West-Indies* than in *Europe*, having been long season-

ed

ed and inured to that climate, either in the king's, or in the merchant's service.

A crew of such men not only carry out a constitution suited to the climate, but, being prepossessed in its favour, are entirely void of those apprehensions, and that dread of sickness, which prove hurtful to unseasoned *Europeans*.

Large men of war ought to have as many as offer of these men: and, in the course of the voyage, it might be proper to have them recruited from the smaller ships, as all new sailors will continue much healthier, and become sooner seasoned in small cruisers.

What I have thus far proposed, though upon the whole useful, I am sensible may be often found incompatible with the immediate exigencies of the service; and is, with due deference, submitted to the consideration of superior judges, and of those who have the superintendance of the medical marine department.—I now pass on to what is more properly the subject of this Essay, viz. To propose the most effectual methods of preserving the health of the men at sea, and of preventing the various diseases incident to them in different climates, and which proceed from their peculiar circumstances and situation.

S E C T.

S E C T. III.

Diseases in Northern Climates.

Of suppressed perspiration. The use of eschalot, garlic, and onions, recommended. A mixture of brandy and beer fermented with melasses, preferable to issuing either beer or spirits alone. Flannel under jackets necessary in winter. A constant supply of fresh provisions and greens proposed for fleets cruising in the channel. Garlic brandy recommended.

I SHALL begin with such diseases as are usual in northern climates, and among the channel cruisers.

Though an intense degree of cold, if the air is at the same time pure and dry, is productive of few diseases, when seamen are sufficiently cloathed, and kept in due exercise, yet such a state of air is not often met with at sea in northern latitudes, nor by our channel cruisers in the winter.—The season is then, for the most part, unsettled, cloudy, moist, and rainy, and the men must necessarily undergo an extraordinary fatigue, during the inconstant and tempestuous weather which they are almost continually engaged with. The usual consequences, are colds, accompanied with feverish and inflammatory symptoms,

toms, and especially *rheumatic, pleuritic,* and *peripneumonic* complaints. These latter cases require plentiful evacuations, chiefly blood-letting; by the early and free use of which, many consumptions, as well as inveterate rheumatisms, a frequent and distressing complaint with old sailors, may be prevented.

As most disorders, especially *catarrhal* fevers, usual at this season, are probably owing to a stoppage of perspiration; whatever promotes that necessary evacuation, seems to promise the most certain protection against these evils. And, for this purpose, I would in the first place, by way of diet, recommend a very simple preservative; it is, the free use of eschalot, garlic, or onions. The two former are put up with the surgeon's necessaries, but are so very cheap, that they may be afforded by the purser, in lieu of the savings of oatmeal. Instead of *Burgou*, water-gruel might be served in a morning to the men, with a proper quantity of eschalot, onions, leeks, or garlic, boiled in it. This will be found as wholesome a mess as can well be contrived for seamen at that season. It will serve as a preservative from the scurvy, and is a warm diluting perspirative; food possessed of these properties, is the proper antidote to the hurtful influences of cold and damp weather at sea.

Most

Most of the Channel cruisers have a quantity of brandy put on board, to be served to the men, when the small-beer is expended ; but there is often occasion for it sooner ; during a violent storm of wind, or in bad weather, when the people are kept constantly wet and chill, and undergo an uncommon degree of fatigue, small-beer does not sufficiently support their strength and spirits. Upon this occasion, an allowance of half their quantity of small-beer, and a quantity of brandy, equal to the remainder, would be found very beneficial. It should be mixed up in the following manner : to a pint of small-beer, add a quarter of a pint of brandy ; let it be sweetened with melasses, and acidulated with vinegar, so as to be made palatable. This is a celebrated beverage in the *Russian* army, where it is called *Ashbetten* ; no regiment marches without carrying a cask of it along with them : and it is by this drink the men are supported, and enabled to undergo their long and fatiguing marches. They indeed use honey instead of molasses ; and their physicians have lately made some improvements in the composition, by an infusion of *Gentian*, and other aromatic bitters, in the spirit, which would seem, however, to be of no great consequence.

This mixture will be found much wholesomer than undiluted spirits; the serving of which to the men, towards the end of long cruises has formerly often contributed to excite general and fatal scurvies in the fleet. The fermentation occasioned by the molasses, or honey, and the addition of vinegar, or, in its stead, *Cream of Tartar*, as shall hereafter be mentioned, will in some measure serve to obviate that, and some other disorders usual in these cruises.

But, at the same time, it is necessary to observe—That dry warm cloathing and bedding, are of the greatest consequence in winter, and without which, other means of preserving health will have little effect. Every man should be obliged to furnish himself with at least two flannel under-jackets, an article which ought to be added to the purser's stores. It is generally the most naked and ragged fellows who are attacked with the winter diseases. When the *Hammocks* are carried up to *Quarters*, they ought always to be covered with a painted canvas, kept for the purpose; it ought to be particularly remembered, that wet cloaths and bedding are frequently a leading cause of sickness in a ship.

The scurvy is a disease common in the winter and spring, and very fatal to seamen

men in the Channel cruisers. But ample directions have already been given for the prevention and effectual cure of this calamity *.

I cannot, however, omit taking notice of one thing: when large squadrons of men of war are kept constantly employed in the Channel service, the length of their cruises, generally from ten to thirteen weeks, often occasions a great sickness; and of late a greater mortality has been observed, than could well be expected in such a healthy climate. When so long a continuance at sea is indispensably requisite, the following has been proposed as a most excellent and effectual expedient, to preserve the health of a fleet.

One of the press-tenders might be ordered out once a fortnight from *Plymouth*, to repair to the rendezvous or station of the squadron, loaded with live cattle and greens, to be served to the men by the purser, in lieu of their salted meats. The men on board of her should have the pri-

* In my Treatise on the Scurvy: where many directions concerning the preservation of seamen, both in health and sickness, are delivered, and which it is deemed unnecessary here to repeat. See also some excellent medical observations in the Appendix to Mr. Ives's Voyage to India, which we recommend to the attention, in particular, of surgeons in the royal navy.

vilege of carrying out, for their private advantage, all manner of roots, fruits, and vegetables, to be sold at a reasonable rate in the fleet: by such means, a market of greens and fruits might constantly be kept by futtlers, who should be only prohibited the sale of spirits. Onions, leeks, shallots, turneps, cabbage, carrots, apples, fresh soft bread, cyder, lemons and oranges; or even the most common herbs in their season, which grow in great plenty wild in the fields about *Plymouth*; such as dandelion, water-creffes, brooklime, and the like sovereign anti-scorbutics, would prove a high refreshment to the men; and would soon be bought up by them either with money, or in exchange with their savings of salt meat and biscuit, which are commonly sold to the purser for ready money, which is expended in pernicious drams.

The run of the storeship, or tender, from *Plymouth* or *Ireland* to a fleet cruising in the *Channel*, will seldom, with a fair wind, prove above forty-eight hours. Many sorts of greens may be preserved for any length of time, by a method afterwards to be described. But there are some articles which the futtlers ought to be obliged at all times to carry out, and be provided with, in proportion to the rate of the ship,

ship, upon pain of forfeiting their licence. These are either the *Rob* of lemons, or juice of oranges *; and the juices of the abovementioned common antiscorbutic herbs, which being mixed with a sixth part of brandy, will remain good for many months.

It is hardly to be supposed that any man, who has the least tendency to the scurvy, would not willingly give a piece of salt beef, or a pound or two of biscuit, to purchase these obvious means of health, and a reprieve from dying of a most painful and loathsome disease. By a proper established regulation of this sort, not only some thousand lives might be preserved, but the ships would be enabled to keep the seas longer, and not be so often under the necessity of quitting their station, on account of a sickly, dying, and dispirited crew †.

I shall conclude this part of my subject, with some directions which may be of use to particular persons, in cold winter cruises.

* See my Treatise on the Scurvy.

† Since the first publication of this proposal, the remarkable good effects of supplying the fleet with fresh provisions and greens at sea, and in the Bay of *Biscay*, have been fully experienced in the grand fleet under Sir Edward Hawke and others, Anno 1759, 1760, &c. by which means our sailors were preserved in the most perfect state of health.

The most proper spirit a man can use by way of a cordial dram, at this season, is garlic brandy. He will find a much less quantity of it, than of the pure spirit, warm his stomach; and it will keep the breast, skin, and kidneys, free from obstructions. But it may be worth while to subjoin a caution, that when a man is almost chilled to death by excessive cold, as I have known some by falling asleep in their watch upon deck, a dram of any spirit often proves instantly fatal. In this state he ought immediately to be put to bed, and to take some warm thin drink, such as warm water, water-gruel, sage-tea, and the like; afterwards the distilled spirit will prove less dangerous, and more beneficial, in restoring warmth. Private *Messes* will reap benefit in cold rainy weather, by the use of sage, sassafras, or a few toasted juniper berries, infused as tea, with the addition of a small quantity of garlic brandy.

In this climate, it is not the degree of cold in the air which affects health so much, as the sudden changes from heat to cold, or from cold to heat; *also* the dampness of the air—A man will not be near so subject to take cold when he is wet upon deck, and using exercise, as afterwards when he goes below deck, and sits
long

Unwholsomeness of new-built Ships. 23

long at rest in his wet cloaths; and especially when he sleeps in them, or in a damp bed. Nor will he at any time be so liable to be affected in his health by the weather, if, before going upon deck, he either eats somewhat, or drinks a little of the *Ashbetten*, with a bit of biscuit, as he would be if the stomach was quite empty. There is also much less danger from being wet with sea water than with rain.

S E C T. IV.

Unwholsomeness of new-built ships.

Dangerous vapour exhaling from new timbers; its effects; methods of obviating them. New ships improper for long and sickly voyages. Impropriety of washing the decks after sun-set.

THE freshness of a ship's *Timbers* is sometimes a general cause of sickness. A vapour constantly exhaling from the wood may be felt, and is often seen by candle-light in a well illuminated ship. It appears sometimes like a thin mist, and at other times like a luminous stream. A prevailing dampness is likewise evident in

24 *Unwholsomeness of new-built Ships.*

the mould and rust with which every thing liable to either, is affected. It produces irregular fevers, accompanied with a flux and dangerous symptoms. These bad consequences, it is much easier to prevent in the dock-yard, than after the ship is built: for, notwithstanding repeated fires made to dry the timbers, this sweating of the wood will continue for some months, in a cold country. Fumigating the ship frequently, when at sea, with the steams of tar, or pitch, may, perhaps, in some measure, correct this pernicious vapour. It is attended with fewer bad consequences in small well-aired vessels, than in larger ships, and very large new-built damp men of war, are found not so proper for long and sickly voyages, as those which are dry and well seasoned *.

* This article, not sufficiently attended to, well deserves consideration. Experience, the test of truth, confirms the inconvenience which seamen suffer from the vapours which exhale in a recent built ship.

Whether the exhalations from the sappy wood operate otherwise than as simple moisture, may admit of some conjecture. In many instances where the smell cannot distinguish the presence of any effluvia, they will, however, exert no inconsiderable influence. Thus, Turners, in working the wood of the *Manchaneel*-tree, would be severely affected, did they not securely guard against its poison. A field of poppies has been known

When

Unwholsomeness of new-built Ships. 25

When the service demands any formidable succours to be sent abroad, the *Mediterranean* seems to enjoy that happy mediocrity of climate to which such damp ships might be, with the greatest advantage, appropriated; for a climate subject to a moist air or atmosphere, like our own, or that of the Channel, would protract the seasoning of the wood, and the extreme heat of the torrid zone would have its inconveniencies.

It is further necessary to give a caution against the preposterous custom of washing the decks after sun-set, from being vulgarly supposed of service to the timbers; as in whatever country or season this method is pursued, it cannot fail of being greatly detrimental to the seamen's health.

to induce a sleepy disposition in the by-stander. The exhalations of *Fraxinella*, and some other plants, are said to be luminous in the warmer countries in a very dry and calm season: and the celebrated *Van Swieten*, in the early part of his life, suffered, repeatedly, a temporary loss of memory, from the vicinity of a plant to him. Vapours from wood, especially when inclosed as in a ship, may, besides their common relaxing quality, convey indisposition peculiar to their respective natures. This by way of speculation.

I have lately observed, that ships built of dry seasoned wood, and especially where wood fires are often burnt betwixt decks, are thereby exempt from sickness.

SECT.

S E C T. V.

Directions in Southern Voyages.

Usual Diet to be changed. Allowance of salt meat to be diminished.

FOR the preservation of the crew in a southern voyage, methods very different from what have been directed, will be found requisite. And as in these voyages, on account of their length, variety of climates, and the unhealthy harbours ships often put into, they incur a greater risk of sickness, and are with more difficulty recruited than in *England*, therefore I shall treat this part of my subject at greater length. But before I proceed to the diseases incident in those climates, it may be proper to premise some general directions for their preservation.

In an intended voyage to the coast of *Guinea*, the *East* or *West Indies*, the first point of consequence to the future health of the men, seems to be to make such a change in the diet or ship's provisions, as may prepare the body for the alteration it must necessarily undergo, by passing from a cold to a warm climate.—Every one's experience must convince him, that both the appetite and digestion are considerably im-

impaired in hot weather. It is the same in sultry climates.

Instinct has taught the natives between the tropics to live chiefly on a vegetable diet, on grains, roots, and fruits; with plenty of thin diluting liquors. Whereas a full animal diet, and malt liquors, are found to be better adapted to the constitution in our own, and other northern countries. We observe the sailors in winter, and especially such of them as visit the *Greenland* seas *, to be remarkable for a voracious appetite, and a strong digestion of hard salted meats, and the coarsest food. But the same men, when sent to the *West Indies*, become soon sensible of a decay of appetite, and find a full, gross, salted diet, pernicious to health.—It is, indeed, a truth evinced by most fatal experience, that their devouring of large quantities of flesh meats, and using the same heavy food in the *West Indies*, or upon the Coast of *Guinea*, and in other warm countries, as they were accustomed to at home, have proved the destruction of many thousand *English* in those climates.

The first step then to be taken, with a view to preserve the health of a Squadron

* See the bishop of *Bergen's* History of *Norway*, Vol. II. p. 271.

of ships in such voyages should be to diminish the quantity of salt flesh provisions. This becomes the more necessary in such a voyage, as the men are, for the most part, put to short allowance of water.—Now nothing can be more pernicious to a ship's company, than a full diet of salted beef and pork, and at the same time a small quantity of water; being productive of scorbutic and many other diseases, fatal at sea, which no other measure can avert, but a diminution of the government's allowance of beef and pork, in proportion to the scarcity of water. Another very material objection against a full diet of salted flesh in hot climates is that no beef or pork can possibly be preserved, by sea-salt, free from a taint or a degree of putrefaction, as evidently appears by the greenish streaks in the fat. This might possibly be prevented by the addition of a little nitre in salting, whose virtue is allowed to be proportionably enforced in the warmer latitudes.—But such considerations are foreign to my present purpose.

There are not wanting instances of the good effects attending this method of putting the ship's company, in long voyages, upon a very short allowance of salt meats. The following is too much to the purpose to be omitted, as it seems to demonstrate

monstrate the utility of the measure, by a comparative trial, at different times, of its effects.

In the former war, the men belonging to the *Sheerness*, bound to the *East Indies*, apprehensive of sickness in so long a voyage, petitioned the captain not to oblige them to take up their salt provisions, but rather to permit them to live upon the other species of their allowance. Captain *Palliser* ordered, that they should be served with salt meat only once a week, viz. beef one week, and pork the other. The consequence was, that after a passage of five months and one day, the *Sheerness* arrived at the *Cape of Good Hope*, without having so much as one man sick on board. As the use of *Sutton's* pipes had been then newly introduced into the king's ships, the captain was willing to ascribe part of such an uncommon and remarkable healthfulness, in so long a run, to their beneficial effects: but it was soon discovered, that, by the neglect of the carpenter, the cock of the pipes had been all this while kept shut. This ship remained in *India* some months, where none of the men, excepting the boats crews, had the benefit of going on shore; notwithstanding which, the crew continued to enjoy the most perfect state of health. They were, indeed,

deed, well supplied there with fresh meat.

On leaving that country, knowing they were to stop at the *Cape of Good Hope*, and trusting to a quick passage, and to the abundance of refreshments to be had there, they eat their full allowance of salt meats, during a passage of only ten weeks; and it is to be remarked, the air pipes were now open. The effect of this was, that when they arrived at the *Cape*, twenty of them were afflicted, in a most miserable manner, with scorbutic and other disorders. These, however, were speedily recovered on shore by the land refreshments.

Being now thoroughly sensible of the beneficial effects of eating, in those southern climates, as little salt meat as possible, when at sea, they unanimously agreed, in their voyage home from the *Cape*, to refrain from their too plentiful allowance of salted flesh. And thus the *Sheerness* arrived at *Spithead*, with her full complement of 160 men in perfect health, and with unbroken constitutions; having, in this voyage of fourteen months and fifteen days, buried but one man, who died in a mercurial salivation.

S E C T. VI.

Necessaries for the Sick.

*Portable soup, new baked bread, wine, rob,
or juice of oranges and lemons; cream of
tartar recommended.*

ACcording to the regulations of the *French* service, I am told that every squadron, consisting of a certain number of ships, is provided with a tender, to carry out necessaries for the sick. The principal articles are, live stock, flour for fresh bread, wine, &c. The fresh animal provisions must needs be of great benefit though a larger quantity of them be more indispensably necessary both in the *French* and *Spanish* fleets, than in ours, because the *English*, in medical practice, do not permit the use of flesh soups in fevers and in several other cases, which the *French* and *Spanish* practioners do *. These flesh

* The *French* allowance for their sick, is said to be eighteen ounces of soft new-baked bread, and three-fourths of a *French* pint of wine a day. They carry out fowls of all sorts, bullocks, sheep, kids, eggs, &c. which are distributed to the patients according to the direction of the surgeon. Their other necessaries are pretty much the same with those furnished to *English* men of war, viz. rice, barley, sugar, tea, prunes, raisins, vinegar, spices of all sorts; also butter, oil of

soups, when required at sea, might occasionally be prepared at any time out of a portable soup, which the shins, the necks, hearts, and other offal of the cattle, killed at the victualling office, might supply. The portable soup of mutton, as less viscid than that of beef, (which viscosity, indeed, dilution will correct) or a mixture of both, might, occasionally, give it an acceptable variety and relish to sick and delicate stomachs.

Besides the satisfaction which would arise in common, from conferring benefits on the sick, the most divine of charities, the advantages, which those in a convalescent or recovering state would derive from this establishment, would abundantly recompence to the state, the apparent additional expence, as the preservation of its naval subjects would, in the end, prove the most frugal plan *.

New baked and well fermented bread too, from its being sooner subdued, and

olives, &c.—We indeed have, perhaps, a better assortment of preserved fruits, which are extremely useful, such as tamarinds, currants, preserved ginger, &c.

* It gives me no small satisfaction to observe, that since the first edition of this essay was sent to the press, the government has introduced into the royal navy, an allowance of portable soup; a regulation, on which the service may be truly congratulated; nor is it less laudable than advantageous to the public, and deserving from our seamen the warmest gratitude.

con-

converted into nourishment by the weakened digestive powers, as well as on account of the inability of scorbutic patients to chew a harder substance, might be very advantageously allowed the sick. Nor could the quantity consumed by them, though daily made aboard, be any inconvenience to the necessary oeconomy and business of the ship. An addition to the leaven of a little *Castile* soap dissolved in water, makes a bread of the most easy digestion.

Wine has likewise its merits: it is found in many fevers, especially towards their decline, to exceed, by far, the shop medicinal cordials; and when the fever is entirely gone, it proves the best and quickest restorative which a sailor can have at sea. Rum, or other distilled spirits, in whatever manner diluted or acidulated, do not, in such cases, produce the like effects. It will also appear in the sequel, that the use of wine becomes an excellent preservative against the infection of contagious diseases in a ship. To answer these salutary purposes, I would advise, that, before the stock of *Madeira*, *Canary*, or other wine, is quite expended, some casks should be reserved for the use of the sick in the voyage. This may be issued to them at proper seasons, as the surgeon may direct, in

lieu of rum, or whatever spirits are in use at the time.

I am of opinion, that proper regulations for preventing the abuse, and improving the benefit that may be derived from such vinous and spirituous liquors as are allowed to the men, cannot fail, at all times, to have a very remarkable influence on the health of the crew. The abuse of these liquors, more especially the swallowing down large quantities of undiluted spirits, is of the most fatal consequence in every climate, and has been the bane of many thousand seamen; while, on the other hand, it is most certain, that by proper management, these noxious draughts might be converted into a sovereign remedy in unwholesome climates. This, the officers, who drink more of them than the common men, daily experience. Observation has indeed sufficiently instructed us, that distilled spirits, well diluted and acidulated, and used in a moderate quantity, are wholesome, and even proper for healthy labouring men in hot weather. Somewhat is requisite to support the strength of such people, and perhaps punch is the most salutary liquor that can be contrived to answer this purpose; besides its immediate cooling, refreshing, and invigorating quality, it is well adapted to prevent the

the diseases arising from hot and moist weather.

As an easy method has been lately pointed out of making such large quantities, at a time, of the rob, or extract of oranges, lemons, or limes *, as must reduce them to a low price, mariners, and all other inhabitants of the torrid zone, may now be supplied with an excellent preservative of health, in such unhealthy climates. One of the greatest physicians † of the Indies makes the following remark: "The
" most knowing practitioners in India
" place greater confidence in lemons a-
" gainst the malignant diseases, pestilential
" fevers, &c. of the country, than in costly
" bezoar or theriac. For my own part,
" says he, I affirm, that in my practice
" there, I found more benefit from them,
" than from any one single remedy."

Syrup of lemons ought always to be put in the surgeon's medicine chest, and be occasionally prepared and renewed in a sufficient quantity, at every port, where these fruits are cheap and in season. Orange juice, an excellent succedaneum for lemons, may be preserved, during the course of the longest voyage, in the following manner.

* See my *Treatise on the Scurvy*, third edition, p. 163, and 164.

† Bontius de *Medicina Ind.*

Care must first be taken to squeeze only sound fruit, as a tainted orange will endanger the spoiling of the whole; the expressed juice must be depurated by standing a few days, or filtrated till it is pretty clear; then it is to be put into small bottles, none of them containing more than a pint of juice; in the neck of the bottle, a little of the best oil of olives is to be poured, and the cork well sealed over.

For want of these fruits, or their juices, I would suggest another vegetable acid for the use of the navy, which is *Cream of Tartar*. A *Drachm*, or the eighth part of an ounce of this, will be sufficient for each man a day, and for half a pint of spirits, mixed with a pint and a half of water. This *Cream of Tartar* is the essential salt of wine, and is an agreeable acid. If the officers, and others in the ship, who make use of lemons or oranges, would reserve the peels to be put into the spirits served to the men, it would greatly improve the flavour of the punch, and make it little inferior to what is made with lemon-juice. I must add, that this is so innocent an acid, that it may be taken in the quantity of an ounce or two, without producing almost any sensible effect, except gently moving the body.

It

It has hitherto been the aim of those, who have made marine diseases their study, to find out a proper agreeable acid, which sailors might be induced to use, as the best preservative against many of their diseases. Vinegar, spirit of salt, *Elixir* of vitriol, and many others, have been severally recommended, and have been experienced, under proper circumstances, to have produced good effects: *Cream* of *Tartar* has the advantage not only of being much more palatable than any of these acids, and, according to the sentiments of doctor *Boerhaave*, and my own experience, beneficial, and well adapted to the constitution of mariners; but is also the cheapest acid that can be recommended for the purpose. An allowance of the eighth part of an ounce a day, will not cost the government one shilling yearly, for each man in the *West-Indies*. I judge the best method is to pour a quantity of boiling water over-night on the cream of tartar, and next morning a pure transparent liquor may be poured off from the tartar at the bottom. Bad water is even thus corrected and purified. About two pounds and a half of the *cream*, I think, will be sufficient for making into punch a hog-head of water: or, as it is now a general practice to mix water with the spirits, be-

fore serving them to the men, a due proportion of this sowering may be issued to each mess. And each man having it in his power to exchange part of his salt provisions (which are so detrimental to health in hot countries) with the purser for sugar, may then be daily supplied with a quart of excellent punch: nay, even an increase of the ordinary allowance of punch, provided it is served out at different times of the day, may safely be indulged, in lieu of salted meats; the inflammatory quality of the spirit being greatly corrected by mixing it in this manner.

The opposing quality of acids to the intoxicating power of spirits, is observable on more occasions, than that of the *analysis* of wines. From a mixture of vinegar and spirit of wine, will result such a combination, as shall efface the different tastes of both, and destroy, in a manner, those properties by which they are usually distinguished. The fiery nature of the one becomes thus qualified and attempered by the other.

SECT.

S E C T. VII.

Method of obtaining Vegetables at Sea.

Means of preserving greens, pot-herbs, &c. fresh for a considerable time. Method of raising a sallad at sea.

I HAVE found by repeated experiments, that it is easy to preserve greens, pot-herbs, and proper vegetables, a sufficient time at sea. The method, however simple, is effectual; and although it may be deemed inconvenient to carry out a sufficient quantity for the daily use of the whole ship's company, yet particular *Messés* may reap great advantage from it.

All have it in their power to enjoy the green and fresh productions of nature; and surely men, the most regardless of their own health, must esteem a dish of greens with their salt meat as a delicacy, after having been some months at sea. The last experiment I made, was this: on the 5th of *March*, I took a parcel of common *coleworts* and *leeks*, and, after washing them clean, shook the water well off, and cut the leeks into pieces of an inch or two in length, and stripped the *coleworts* from off the thick stalks; then having procured two wooden dishes, well seasoned with a

40 *Method of obtaining Vegetables at Sea.*

strong boiled pickle of salt, I sprinkled, when dry, a thin layer of pounded bay-salt on the bottom of each, upon which was spread a thin layer of the vegetable, covered with dry bay-salt, and so alternately, until the one was filled with coleworts, and the other with leeks. A cloth, wrung out of boiled salt pickle, was afterwards put upon the mouth of the vessel, and the whole pressed down with a weight. On the 5th of *June*, after they had been kept three months, I took out a little of each, and observed the leeks to retain their strong peculiar flavour. After opening the folds of the leeks, in order to wash out the salt, the vegetables were put, for about ten minutes, into cold water to freshen, then to be boiled; when, upon a comparison, both of them were found, in every respect, equal to what had that morning been taken out of the garden. The entire verdure and tenderness of the coleworts, and the perfect flavour of the leeks, were preserved, without the least degree of saline impression.

I have kept greens for the pot, prepared as above, for upwards of ten or twelve months, when they still retained their perfect verdure, succulency, and taste. It is necessary to add this caution, that earthen vessels are improper for preserving

Method of preserving Vegetables at Sea. 41

serving greens in this manner, because the salt in a short time will penetrate their substance, and the outside of the vessel become crufted over with saline efflorescencies.

Further, I have with the seeds of garden *Cresses*, which had even been kept for two years, raised a salad in the middle of winter, in a room when there was no vegetation abroad : and the same is practicable in all parts of a ship. Let wet cotton be spread thin on the surface of water, about two or three inches from the bottom of the vessel, to give room for the roots to shoot down. The seeds being sown upon the cotton, the cresses will in a few days come up.

The water here used is not lost, it becomes strongly impregnated, both with the flavour and taste of cresses ; and may be used as a preservative against the scurvy.

It is beautiful, in a glass vessel, to behold daily the quick progress of vegetation, both above and below the surface of the cotton.

When there is a plenty of water on board, or in a rainy season, blankets may be converted into gardens ; and the whole ship both above and below, as also her sides, be replete with verdure. Nothing more,

more, as I find by experiments, being requisite, in this climate, than watering the blanket on which the seeds are sown, twice a day, and allowing two inches room for the roots to shoot.

S E C T. VIII.

Accidents frequent in Ships.

Treatment of persons under extreme intoxication. Means of recovering such as are supposed to be drowned; suffocated by the noxious vapour from a ship's well; or struck by lightning.

ONE piece of advice may not be unacceptable, in an unpitied, but sometimes dangerous condition: I mean, the voluntary disease of drunkenness; a state from which numbers never wake, and many but return to memory, to fall the victims of the fever it produces, especially in hot climates: a caution therefore may be the more needful, as it is a case too frequent on ship-board, and as I do not remember that its treatment has been often spoke of.

In the fit of stupefaction, it is but too usual for the delinquent to lie in an horizontal position, or, what is much worse, with his head hanging down. This situation

ation should be immediately altered to an erect, or gently-inclined sitting posture. If in a bed, or *Hammock*, his head should be raised, and due care taken that his senseless state does not change it. Warm water, with vinegar should be given him, and a sponge dipt in vinegar, applied to his head, mouth and nose. Instances of the good effects of this method have been frequently experienced. The propriety of giving an emetic, in this case, of gentle, but speedy operation, is almost too obvious to be inculcated, as also the necessity sometimes of blood-letting and giving solutive clysters: these, I say, with plentiful perspiration, (generally a salutary, but now a most needful evacuation) are the usual methods when any extremity threatens. Those who can walk in the air, or sit up with an over-dose of liquor, will do well to avail themselves of that security, till the kidneys, or some other strainer, has abated the fullness of the vessels; for going suddenly to sleep in an inebriated state, has, by suffocation, or apoplexy, put a period to many lives. This vice of drunkenness, one of the most destructive to our brave seamen, ought to be discouraged by all possible means, and severely punished by the officers.

44 *Accidents frequent in Ships.*

Let us next turn our eyes to those in a state more justly demanding the attention of humanity; such as have been unfortunately drowned. As soon as a person supposed to be drowned is taken out of the water, he ought not, as usual, to be held up long by the heels; the continuance in such a posture is the most likely means to prevent him from coming to life. The head must be inclined in a position favourable to empty the stomach; mean while the utmost dispatch should be used to remove all the cold, wet cloaths, by stripping the person quite naked, and immediately exposing the body to the heat of the warm sun, or a fire, to prevent stiffness and cold; or, to regenerate heat, he may be put in a bed well warmed, where the belly, breast, and especially the pit of the stomach, must be well and constantly rubbed with warm clothes, or dry salt, keeping the head and face gently inclined forwards, as in a person under the operation of an emetic. At the same time, the limbs must be well chafed with hard coarse clothes, made very warm, and the whole body often shook or rolled about. All possible attempts must be made from the beginning to bleed; and that, even, in different veins. The temporal artery may also be cut. Warm bricks, or bottles
of

of hot water must be applied to the feet; salt of hartshorn or volatile salts and spirits to the nostrils; and air, moderately heated by being near the fire, blown by means of a bellows into the lungs, or even into the anus. Or, a person that chews garlick may endeavour to blow into the mouth with his breath, keeping the nostrils of the patient shut for a short time, to prevent its escape: mean while, another person, by a gentle alternate pressure and dilatation of the ribs, with a corresponding alternate compression of the contents of the belly upwards, imitates as nearly as possible the act of respiration in a living body. A clyster of tobacco smoke may also be given, and tobacco moistened, or its juice, may be put into the mouth, from the irritation of which in the throat and stomach, a recovery and vomiting has sometimes ensued. Sometimes also such persons have been again brought to life by being stripped and having their bodles covered with warm salt or dry pot-ashes. Though these means should not speedily produce the desired effect, yet the person is not to be relinquished. They must be repeated and continued for some hours, keeping the body all the while warm, or in a hot place, persevering in the concussions and rollings; and lastly, he may
be

be immersed up to the chin and kept for some time in a bath of luke-warm water, after which, the former means are to be again tried. The frequent opportunities I have had at *Haslar* hospital of visiting men who had newly escaped being drowned, and remained long under water, led me to observe, that in general the constitution suffers so much by the shock, that the person is sickly for a considerable time afterwards. He should be treated in the same manner as if he had been much bruised.

When a person is suffocated by the noxious vapour of a ship's *Well*, (an accident not uncommon) the same means are to be used for his recovery, as have been prescribed for people drowned; only there is here no occasion to strip him of his cloaths, till other methods have been used, especially opening the veins, dashing a bucket or two of cold water on his face, naked stomach, or thighs, by the shock of which many have instantly recovered *.

* Directions published by the society in *Holland*, which have been successfully used for the recovery of persons supposed to be *drowned* or *suffocated*, and by which means in four years 150 persons, who had no visible appearance of life left, when taken out of the water, have been perfectly recovered.

And

And a like method may be practised with those struck with lightning. Accidents from lightning are frequent on ship-board, owing in a great measure to the height of the masts, from which it is thrown upon the deck. Perhaps future experience may evince the utility of having proper conductors fixed at the mast-head, and in the shrouds; by which the lightning may be carried off from the ship into the sea.—Mean while, it is adviseable

To forbear from rolling the body over a cask, tying it by the legs with the head downwards, and every other species of rough usage, intended to disgorge the water, which is vulgarly *supposed* to be swallowed by drowned persons.

They direct, in the first place, to force air into the body, either at the mouth, or up the intestines; and recommend the vapour of tobacco as more stimulating than common air.

Secondly, to strip off, as soon as possible, the wet cloaths, and to apply external heat to the body, by means of friction with flannel before a fire.

Thirdly, to rub the body all over, especially the back bone, with woollen or flannel cloths, wetted with brandy, and strewed over with salt.

Fourthly, to chafe the temples with the volatile spirit of *sal ammoniac*, holding the same to the nose.

Fifthly, to put the person into a bed, without sheets, and covered with many blankets; and to have the additional natural warmth of two persons in bed, putting at the same time a bottle of warm water to the sole of each of his feet. And

Lastly, they direct, that as soon as any pulsation, or breathing is perceptible, eight or ten ounces of blood should be taken from the arm.

for

48 *Preservatives of health on board Ships.*

for the preservation of the men who are exposed to it upon deck, that, during violent thunder and lightning, the officer takes the first opportunity of a heavy rain falling, to employ them in some ship-duty, with a view that their cloaths may become wet.—And all should avoid standing too close to the foot of the mast, or to the wet shrouds or ropes coming from thence.

The principles upon which those advices are founded, are too well known to require my dwelling longer on this subject.

S E C T. IX.

Preservatives of Health on board Ships,

Ventilators, exercise, cleanliness and the cold bath recommended.

I Should be wanting in my duty to the public, if I should omit, in these general directions for the preservation of seamen, the use of doctor *Hales's* ventilators *. I must add, that the more the men are kept in exercise and action during fine and calm weather, the better will their health be preserved: and it is each man's interest to take care, that his chest,

* See his Book on Ventilators.

cloaths,

cloaths, and bedding, be often aired, and kept as free as may be from damp and rottenness. Those, who are remiss in these articles, should be compelled to become more cleanly.

The ordering as many of the men as can be prevailed upon to use the cold bath, either in tubs under the *Fore-castle*, or to dip in the sea, early in the morning, has been found extremely beneficial in warm weather, and in hot countries. The body is thereby cooled and refreshed, the fibres braced and invigorated, so that the men become afterwards better enabled to undergo the fatigues and heat of the day. This would prove not only an excellent means of health, but of cleanliness: and indeed it has been found experimentally true, that the cold bath is of sovereign use to the *Europeans* in the Torrid Zone; and that by cleansing the skin, and invigorating the whole habit, it is so far from stopping the perspiration in hot weather, that it promotes it. I can affirm, from my own experience in hot climates, that *Fluxes* and many other complaints, the sole effect of an unusual and great heat, (relaxing the solids) have not only been cured by cold bathing, but the return, and even the attack, of such diseases, effectually prevented by it.

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BOSTON MEDICAL
AUG 15 1927

Preservatives of Health on board Ships.

I am persuaded that the remarkable healthfulness of the *Tyger* ship of war, commanded by captain *Latham*, in her late voyage to the *East-Indies*, was more owing to the use of the cold bath, than to any other circumstance *. It is worthy of observation, that, in this voyage, two ships kept together in company, and were pretty much of the same rate; yet, at the end of it, one of them had above two hundred men sick on board, whilst the other had not above nine or ten. This proves, I think to a demonstration, that very minute circumstances in a ship often occasion, or prevent, a general sickness, and consequently a great mortality in a voyage.

Most people know, that the cold bath, though very serviceable in sultry weather, and at such a time often absolutely necessary, as I have experienced in my own person in hot countries, yet may be injudiciously and preposterously used. The abuses are, too long duration in the water, or when the sailors are permitted to go into it over-heated with work or liquor,

* See a letter from captain *Latham*, inserted in the *Gentleman's Magazine*, in the month of *April*, 1755. It is dated from *St. Augustin's Bay*, in the island of *Madagascar*, 9th of *September*, 1754.

when

Diseases in Southern Climates. 51

when the stomach is full, or when a critical eruption, called the *Prickly Heat*, appears upon the skin.

S E C T. X.

Diseases in Southern Climates.

Impropriety of indiscriminate Bleeding by way of prevention. Danger of crowding ships with men. Epidemic fever of hot climates, its cure, and method of prevention.

THESE general directions being premised, I now proceed to treat more particularly of such diseases as are usual, in hot, sultry, and unwholesome climates; with a view to point out what promises the most certain protection against their attacks.

The first diseases which occur in a voyage to the southward, are, for the most part, of an inflammatory nature, and owing to a sudden transition from cold to hot weather. This occasions a fulness and distension of the vessels; hence, such disorders, and hence, all *Europeans*, upon their first arrival under the Tropic, bear evacuations much better than afterwards. It has been a common practice at sea, to bleed a number of the ship's company, when first they come into a warm latitude,

52 *Diseases in Southern Climates.*

by way of prevention: but experience does not shew, that this operation has any such effect upon their future health; nor can the propriety of bleeding almost all the men, as it is often done in the merchant's service; without distinction of age or constitution be well justified; though we allow bleeding, in some particular cases, useful at this time. I shall endeavour elsewhere * to particularise the cases in which this operation is necessary; let it suffice for the present to observe, that previous blood-letting is not to be depended upon as a security against the diseases of intemperate climates.

It often, indeed, happens, that the men enjoy an uninterrupted state of health in the Torrid Zone, when the ship meets with fine weather, and has a good passage, especially when she leaves *England* in the autumn, and arrives at *Jamaica*, or other places to the northward of the æquator, when the sun is pretty well advanced towards the southern tropic: it being generally upon their arrival in harbour, and after anchoring in sickly places, that the men are attacked with the diseases of the country.

* In the Appendix.

The

The contrary, however, may sometimes happen. It has been remarked, that when ships crowded with men * have a tedious passage, or are long becalmed at sea †, during a continuance of hot, moist, and close weather; or when they suffer by heavy rains, usual at particular seasons, within the tropics, diseases different from the former, and much more fatal to the

* It is a mistake, destructive to the men, to crowd too many of them together in a Southern voyage, or in a hot climate, as the ship will be found, before the end of the voyage, in much more distress for want of men, than she would have been, had she at first carried out only her proper complement. An additional number is often made, in order to supply an expected mortality; but they generally encrease that mortality to double or triple their own number. This fact has been often confirmed by experience in foreign services, and lately in the *Pitt*, an *East India* armed ship, and several others. Ships are also very apt to be harrassed with low fevers and fluxes (the consequence of the fever) when much crowded with stores and provisions, from not having proper room and conveniences for their men; and if any article become putrid, the danger will be greatly increased; stock-fish used in *East India* voyages are particularly apt to become so. It will, therefore, be proper when any species of provisions turns offensive, immediately to throw it into the sea.

† Calms are frequent near the equator, and in hot weather; when they continue long, the sea becomes offensive, and is covered with a scum, so that men on going upon deck, are frequently seized with a sickness and vomiting from its smell. This scum is supposed by seamen to be the spawn of fish, but is sometimes observed, during long calms, even in harbours.

men than those of the inflammatory kind, begin to appear.

A few of the sailors are sometimes at first seized with fluxes, which denote a bad disposition in the air, and its tendency to beget a malignant fever of the remitting, or intermitting, but most frequently of the *Double Tertian* kind. This fever, which is the genuine produce of heat and moisture, is the epidemic between the tropics, upon the Coast of *Guinea*, and in *Jamaica*; and is the autumnal fever of all hot countries: it is perhaps different from what is called the *Yellow fever*, or *Black Vomit*, which takes place among a few, on their first arrival in the *West-Indies* *.

* Since the first edition was printed, I transmitted some queries relating to the diseases in the *West-Indies*, to Mr. *Nasmyth*, an ingenious gentleman, surgeon to admiral *Holmes* at *Jamaica*, and received the following answers from *Port-Royal*, dated April 15, 1761.

“Q. Is it not the common fever of *Jamaica* of the remitting kind, and nearly such as has been described by *Cleghorn*, as the epidemic of *Minorca*?

“A. The remitting fever is truly one of the fixed regular epidemics of this island; and is more or less prevalent in the months of *October*, *November*, and *December*. I look upon it to be the same as that of *Minorca*, of *Sumatra*, of *Java*, and of many other places in the *East* and *West-Indies*, between the tropics. Here, from the great extent of country, large tracts of uncultivated land, woods, marshes, and a considerable degree of heat and moisture; from these,

In

In this epidemic of the Torrid Zone;
I have found, by manifold experience, in

" I say, and other causes, this fever is found to act with
" full vigour, and often proves very fatal. It termi-
" nates sometimes as common fevers do, by the skin,
" kidneys, or intestines; though oftner, and with
" more safety, as a regular intermittent; when it is
" readily subdued by the bark, &c.

" Q. Wherein does it differ from the Yellow Fever?

" A. An inflammatory *Diatbesis*, with dense blood
" disposing to obstruction, very commonly introduces
" the *Remitting Fever*: the heat too, except in the re-
" mission is pretty equal; and seldom any signs of dis-
" solution in the blood, or tendency to putrefaction,
" appear, until the disease has been of some standing.
" —The *Yellow Fever*, in at least ninety patients of a
" hundred, exhibits immediate appearances of colli-
" quation and approaching putrefaction. The blood,
" in the beginning, is commonly loose and dissolved:
" the great heat soon subsides, when a clammy mois-
" ture succeeds. In this state the heat is really under
" the standard of health; and then it is that putrefac-
" tion becomes general and active.

" Q. Are the patients in this last fever subject to
" profuse hæmorrhages, or other symptoms of remark-
" able colliquation or putrefaction of the blood?

" A. From the early and general dissolution of the
" blood, hæmorrhages are very frequent in this last fe-
" ver; and these too from almost every part of the
" body: the gums, the nose, the corners of the eyes,
" give early proofs of this. Sometimes bloody exuda-
" tions from the fore-head, the arm-pits, from cicat-
" rized wounds, large black spots, and foetid cadaver-
" ous excretions of every kind, confirm the general
" state of putrefaction.

" Q. What diseases do you imagine are produced at
" sea, by the great heat in the *West-Indies*, where in-
" fection and the land exhalation can be supposed to
" have no influence?

the most unhealthy rivers upon the Coast of *Guinea*, that the safety of the patient, in this disease, entirely depended upon the fever's intermitting; or, at least, its remitting so favourably, as might afford an opportunity of throwing in an ounce, or two, of the *Jesuits Bark*. The *Bark* is indeed, at this time, universally known, by practitioners of all nations, to be the only sovereign medicine for this most frequent and malignant fever, in those sickly southern climates.

In the course of my inquiries into this subject, I have had an opportunity of con-

“ *A.* I have remarked in the course of some voyages
 “ to the *East-Indies*, (these, you know, afford the
 “ fairest trial) that the inconveniencies and diseases arising from mere heat, are far less considerable than is commonly imagined. The immediate and most frequent effect of hot air, is rarefaction of the fluids, hence different degrees of fever, from the accelerated pulse, slight head-ach, &c. to a phrensy and highly ardent fever.

“ Upon the subject of thermometers, about which
 “ you seem to be inquisitive; I must tell you, that I
 “ have generally been provided with several; and, in
 “ this present voyage, have endeavoured, as much as
 “ possible, to discover the influence of heat in the production and course of diseases;—for this purpose, I
 “ ascertained with great exactness, the number of men
 “ lodged upon each deck; where lodged when taken ill,
 “ and of what distemper. My observations of the mercury were at stated times, and attended with general remarks of the weather; notwithstanding this exactness and attention, I cannot at present settle any thing
 “ satisfactory or worthy of your notice.”

sulting

sulting the journals, kept in those voyages by many ingenious surgeons of ships of war; and, however irregular, or diversified under different appearances, this fever might shew itself, I found the distemper was essentially the same, and that the bark alone, judiciously administered during a remission, or intermission, proved the most certain means of cure. Many instances might be produced, several histories of fevers might here be related, wherein the efficacy of the bark would be fully evinced. I shall only observe, that the fever of the Island of *St. Thomas*, is, to a proverb in that part of the world, deemed the most malignant and fatal species of any *African* or *American* fever: but by a very accurate account of this fever, which I have had occasion to peruse, it would appear, that the bark is likewise the best remedy.

It is again to be observed, that this remedy proves not only a specific for this universal malignant, remitting, or intermitting fever, but the continued use of it is an effectual preservative against a relapse. Hence one would naturally infer, that the use of the bark would prevent the attack of this sickness; and, accordingly, experience (the surest guide and standard of medical truths) testifies, that
the

the bark proves a defence against the attack of this fever, and other malignant disorders, which may be apprehended in unwholesome climates, during a malignant disposition of the air.—This hint, I first received when on the Coast of *Guinea*. I was informed, that the factories were furnished with proper quantities of the *Bark*, by the late *African* company, which was taken by way of prevention, during the rainy and sickly season; and that it was attended with remarkable success in such as could be brought to submit to a regular course of life, and to refrain from eating such quantities of animal food as they were wont to do in *England*, which yearly destroys many on that coast. I have since been confirmed in my opinion, of its success as a preservative, by many considerations and facts: I shall produce only one.

Hungary is acknowledged to be the most sickly climate in *Europe*, and indeed, as bad as any in the world. Here it was, where the Christian armies, in marching only through the country, in the expeditions against the *Saracens*, formerly called the *Croisadoes*, often lost half of their number, by sickness; and where the *Austrians*, not long since, buried, in a few years, above 40,000 of their best troops, who
fell

fell a sacrifice to the malignant disposition of the *Hungarian* air.—Now the same causes, which subsist in an eminent degree in *Hungary*, render some southern countries injurious to the health and constitution of strangers. *Hungary* abounds in rivers, which, by often overflowing, leave that low, flat country, overspread with lakes and ponds of stagnating water, and with large, unwholesome, marshes. So great is the impurity of these stagnant waters, that by them the rivers, even the *Danube*, whose course is slow, becomes, in places, corrupted and offensive.

The air is moist, and, in summer, quite sultry. In the nights of harvest, it was so very damp, that we are told *, the *Austrian* soldiers could not shelter themselves from the moisture by a triple tent-covering.

Epidemical distempers begin constantly to rage in the hottest months, which are *July*, *August*, and *September*. These complaints, according to the accurate observations of a physician †, who practised long in *Hungary*, are altogether the same with those which are epidemic upon the Coast of *Guinea*, and in the sickly climates of

* Vide *Krameri Observationes de Climitate Hungaricæ*.

† Dr. *Kramer*, Physician to the Imperial army.

the *East* and *West Indies*, viz. malignant fevers of the remitting and intermitting kind, and fluxes.

The heat of the sun in summer is more intense in *Hungary* (according to my author) than in any other part of *Europe*, and, in proportion to the heat, is the pestiferous quality of the marshy exhalations. It is constantly observed, that the nearer any city or fort is situated to a morass, or an ample river, with foul and oozy banks, the more unhealthy are the inhabitants. At such seasons, and places, the air swarms with numberless insects and animalcules, a sure sign of its malignant disposition.

The hotter the summer, the more frequent and mortal are the diseases. This was fatally experienced by the *Austrians*, in the unusual sultry summer-months of the year 1717, and 1718, when they found the climate of *Hungary* a much more dreadful and destructive enemy, than the assailing *Turks*.

In the former of these years, at the siege of *Belgrade*, the fever of the country, and the flux, occasioned a very extraordinary mortality among the troops. The dread of these diseases caused every one (as may naturally be supposed) to have recourse to different precautions for self-preservation,

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The great prince *Eugene*, who commanded in chief, had water, and the provisions for his table, sent him twice a week from *Vienna*. The pure stream of the river *Kahlenberg* was regularly brought to him: he avoided all excesses, and lived regularly, or rather abstemiously; refreshed himself often by eating a cool melon, and mixed his usual wine, which was *Burgundy*, with water. But, notwithstanding his utmost care, this illustrious hero was seized with a dangerous dysentery, which would have quickly terminated life, had not the speedy conclusion of that campaign, permitted him a quick retreat *.

At this unhealthy season, when hardly one imperial officer, much less their several domestics, escaped those malignant diseases, the renowned count *Bonneval*, and his numerous retinue, continued, amidst this pestilential contagion, in per-

* From what *Kramer* and others have advanced, concerning the pernicious constitution of the *Hungarian* air, we may account for the vast and almost uniform fatality of the small pox, and other pestilential diseases, to which that country is unhappily subject. A living author (*Westpremi*, de *Inoculanda Peste*, 1754) a native of *Tockay*, observes, that their extended desarts and desolated cities witness the dreadful devastations made by the malignant evils of this soil. A province, says he, which requires great and annual supplies of colonies from fruitful *Swabia*, to reinstate those whom disease has sacrificed.

fect health, to the surprize, or, to use my author's words, the envy of all who beheld him. The only precaution he used, was to take, two or three times a day, a small quantity of brandy, in which the bark was infused; and he obliged all his attendants and domestics to follow his example.

It is no less remarkable, that the *Count*, placing his certain preservation in the use of this simple bitter, lived for many years afterwards in the most unhealthy spots of *Hungary*, without any attack, or apprehension of disease; and continued to enjoy a perfect state of health, during the hottest and most sickly seasons. And thus, with an unbroken and sound constitution, which is seldom the case of those who reside long in such climates, he lived to a great age.

There is an instance produced by the same author *, of a whole regiment in *Italy* having been preserved, by the use of the bark, from the attack of the same malignant diseases, viz. the *Flux* and *Bilious* fever (as it is often called) when the rest of the *Austrian* army, not pursuing that method, became greatly annoyed with them.

* *Dr. Kramer.*

From what has been already said, there is reason to presume, with a great degree of certainty, that, if his majesty's ships, when bound on a voyage to any of the afore-mentioned unhealthy climates, were supplied with a due quantity of the *Bark*, it might prove effectual for preventing both the *Fever*, and *Flux*, the latter being the same disease falling upon the intestines.

The *Bark* might be made extremely palatable, by infusing it in spirits, especially if a little orange-peel be added. The orange-flavour renders it a bitter of an agreeable taste, and conceals what is offensive in the bark. Eight ounces of bark, and four ounces of dried orange-peel, infused in a gallon of spirits *, will make a much more agreeable bitter dram, than what the sailors often make up for themselves at sea, of *Gentian*, *Snake-root*, and other disagreeable aromatic ingredients.—

* The spirit may be impregnated with a much greater quantity of bark, if necessary, for a more effectual preservation. To which I know no other objection than that the taste will not be so agreeable. Spirits will extract the virtues of triple the quantity of bark here proposed, and thence will become much more efficacious. It is usual now in some of the *Guinea* factories, when taking the bark, to keep the body gently lax by a draught of sea water, occasionally taken in a morning. Those who dislike spirits, may use the bark infused in wine, or boiled in water.

64 *Diseases in Southern Climates.*

Two ounces of this composition, which will be but a very moderate dram to a sailor, may be allowed to each man a-day, upon the approach or apprehension of these malignant diseases.

It, indeed, would be still better, if the men were to be served with only half of this quantity, to be taken upon an empty stomach in the morning, and the other half, when they were called out to their night-watch.

It does not appear, to me, necessary to subjoin any cautions * in the use of so excellent and harmless a stomachic bitter, taken in so small a quantity as is here directed. A whole ounce of bark has been taken, in less than two hours, upon an empty stomach, by persons in health, without being able to perceive from it the least sensible effect, much less any bad

* Where there is apprehension of sickness, the best precepts are those delivered by *Celsus*, viz. To avoid too great fatigue, indigestions in the stomach, immoderate cold as well as great heat, and excesses of every kind: more especially, at such a season, the constitution is not to be weakened by bleeding and purging, for the sake of prevention. If at this time the stomach, or intestines, are oppressed with indigestion, or sharp bilious humours, these may be gently carried off by a draught of salt-water, by a small dose of rhubarb, or rather by a gentle vomit, shunning all great evacuations as hurtful.

one *. Its long continued use is observed neither to offend the weakest hysteric female constitution, nor to ruffle the most sensible and feeble system of nerves in men.

S E C T. XI.

Precautions necessary in Southern Climates.

Ships during the unhealthy season to be anchored at a distance from swamps. The night air to be avoided. Means of defending ships from the noxious land-breezes. The men employed in wooding and watering not to sleep on shore. Rules for such as are obliged to sleep on shore; a well-thatched hut, smoak, and a bark bitter recommended. Account of an extraordinary and unwholsome vapour met with in Guinea.

AS the weather, remote from land in the Torrid Zone, is, for the greatest part of the year, dry and serene, the excessive heat being much moderated by a constant, refreshing, and uniform breeze, the men often enjoy a better state of health at sea, than when they arrive in harbour, or get within reach of the noxious va-

* Vid. Dissert. Medic. de Cortice Peruviano, p. 14. Auctore, Cheney Hart.

pours, which arise from many parts of the land.

I have elsewhere † pointed out the particular unhealthy seasons of the year, and the harbours and coasts most fatal to *Europeans*. Such places, prudence directs to avoid; but this expedient for health cannot always be complied with. Necessity often obliges ships to put into parts, where sickness may be justly apprehended; in order to guard against which, as much as the situation of things will permit, they ought to be furnished with some other necessary directions.

It may, in general, be remarked, that, in sultry climates, or during hot weather, in all places subject to great rains, where the country is not cleared and cultivated, but is over-run with thickets, shrubs, or woods, especially if there are marshes, or stagnating waters in the neighbourhood, sickness may be dreaded, and such a malignant fever of the remitting or intermitting kind, as has been often mentioned. The fens, even in different countries of *England*, are known to be very dangerous to the health of those who live near them, and still more so to strangers; but the woody and marshy lands in hot

† In my essay on diseases incidental to Europeans in hot climates.

countries are far more pernicious to the health of *Europeans*.

When ships are necessarily obliged to put into such unhealthy parts, the first precaution to be taken, is, to anchor at as great a distance from the shore as can well be done, and to prefer the open sea, where the anchorage is safe, to running up into rivers or bays inclosed with the land, and especially where there are high mountains, that may intercept the salutary current of sea breezes. The higher ships sail up the rivers upon the coast of *Guinea*, the more sickly they become: such, however, as keep two or three leagues at sea, beyond the reach of the land breeze, are, for the most part, healthy.

It is not to be expected, that we should be able precisely to determine the distance, to which the sphere of unhealthy vapours, from such woody swampy ground, extends itself; as it must, at all times, greatly depend upon the wind's blowing from that quarter. Thus, at *Rome*, the south-east wind, termed, by the *Italians*, *Scirocco*, which passes over the adjacent marshes, is most unsalutary; and yet the effects of this wind have been experienced to extend only to those parts of the city, which lay nearest the marshes, occasioning an epi-

demic fever, whilst the rest of the city was healthy *.

That the malignity of air, does often not extend its influence to any considerable distance, is farther proved by experience. “ In the year 1747, when some of the *British* troops, partly in camp and cantonments in *Zealand*, suffered an excessive sickness from the marshy bad air, insomuch that not a seventh part of the corps, stationed there, was fit for duty; commodore *Mitchel*’s squadron, which lay at that time at anchor, in the channel, between *South Beveland*, and the Island of *Walcheren*, in both which places the distemper raged, was neither afflicted with fever nor flux, but, amidst all that sickness, enjoyed perfect health.”

A proof, says the learned author †, that the noxious air of the marshes was dissipated, or corrected, before it could reach them.

How far soever the noxious vapours, from unhealthy grounds, may spread themselves, it is demonstrable, that their malignity decreases in proportion to the dis-

* *Lancis. de nox. palud. Effluv. Lib. ii. Epid. i. Cap. 3.*

† *Sir John Pringle, in his Observations on the Diseases of the army. Part I. Chap. 7.*

tance to which they are diffused. Thus, when commodore *Long's* Squadron, in the months of *July* and *August*, 1744, lay off the mouth of the *Tiber*, it was observed that one or two of the ships, which lay closest to the shore, began to be affected by the pernicious vapour from the land; whilst some others, lying further out at sea, at but a very small distance from the former, had not a man sick. At the same time, the *Austrian* army, under the command of prince *Lobcowitz*, suffered so great a sickness, through the proximity of their situation to the marshy country, that they were obliged to decamp.

The facts which have been recited, will, I hope, engage due attention to one very important direction for preserving the health of the men, when a ship puts into a harbour, where sickness may be apprehended from a low, marshy, uncultivated country; which is, that the ship be anchored in the best-aired station, where she may be well exposed to the sea breezes, and, as much as possible, to the windward of the woods and marshes: and the same precautions are to be taken, when a ship arrives in those climates either during, or soon after the rainy season.

The success of expeditions in the *East* or *West Indies*, greatly depends upon their being executed in the most proper season of the year; but it is also necessary that ships upon their arrival should, if possible, lie open to the wind; it will prove the most effectual preservative against the diseases of the neighbouring sickly country; fatal experience having shewn, that riding sheltered from the wind, in secure creeks, and stifling close havens, surrounded with high mountains, has proved the destruction of whole fleets at anchor, while their cruisers at sea have enjoyed perfect health.

If, in such climates, it should happen, that it is impossible to avoid anchoring close to the land, and even in a harbour, where the ship is quite encompassed with woods, mountains, and swampy ground, to alleviate, as much as possible, this misfortune, some other precautions may be taken.

The first, that I shall mention, is that the crew be kept at work, upon deck, as little as the nature of the service will permit, before sun-rising, or after sun-setting, and indeed, only when the sea-breeze blows. This advice is founded upon an observation, that when the sun is above the horizon, the noxious land-vapours are more dispersed; they are then
much

much *rarer* than in the night, or even in the evenings and mornings, when they become denser, and more hurtful. Add to this, that the land-wind conveys them in a greater quantity towards the ship. Now, the night-air at land, in those southern climates, is always very moist, occasioned by the excessive dews which are experienced to be extremely pernicious to such persons, as are exposed to them*. Although we may suppose the falling dews to be impregnated with unfavourable exhalations, from the earth or land-air, it is nevertheless certain, that extreme moisture greatly favours the exertion of their unfriendly influences.

That an impure air has an effect, in proportion to its moisture, upon the health of the men, and even upon the most hardy constitutions, would appear by the following curious experiment.

* In *Arabia*, and some other Eastern countries, the *Dews* are experienced to have none of those bad qualities. But in *Guinea*, and in many parts of the *East* and *West-Indies*, the dews on shore have been extremely fatal to many *Europeans*; more especially when, molested with the heat within doors, and the plague of moschitoes, they have ventured to sleep in the open night-air. The *Negroes* and *Credles*, sleeping without hurt in the dews, is a proof how far the constitution may be framed and accustomed to bear what otherwise is so highly prejudicial.

In the year 1748, upon the breaking up of the *British* camp in *Flanders*, the cavalry were cantoned in the unhealthy ground about *Bois-le-duc*, and soon after were attacked with a general sickness, occasioned by the late inundations of that part of the country. Dr. *Home*, then surgeon to *Cope's* dragoons, observes*, that the troops suffered in proportion to their proximity to the marshes, and that universally, the nearer to *Bois-le-duc*, the more violent was the distemper: the number of the sick, by a very accurate observation, being found exactly to correspond with the dampness of their situation, and of the air. To put this matter beyond all doubt, this ingenious gentleman provided himself with a good *Hygroscope*, by which he carefully measured, every day, the degree of moisture or dryness in the air; and, upon comparing his tables with the register kept of the sick, he found, that the progress of the disease kept an exact pace with the humidity of the air.

On the 29th of *June* they left the camp, and from that day to the 12th of *July*, the air being dry, not one soldier was taken ill. On the evening of the 12th, the *Hy-*

* In an elegant performance, entitled, *Dissertat. Medica inaug. de Febre remittente*, p. 14, &c.

grometer indicated a great degree of moisture in the air, and that very night the epidemic sickness (viz. the remitting fever) began among the troops; three dragoons of *Cope's* regiment being seized with it. During eight days afterwards, the air continued extremely moist, and the number of the sick was proportionally increased. The ten following days being drier, the number was visibly diminished. But two very moist days succeeding, the patients were again greatly encreased. In a word, the same quality of the air, which differently affected the *Hygrometer* did also every day, in like manner, affect the health of the men *.

When a ship at anchor is near marshy ground or swamps, especially during summer or in hot weather, and the wind blows directly from thence, the gun-ports, which would admit such a noxious land-breeze, ought to be kept shut, especially at night. Or, if the ship rides with her head to the wind, a thick sail ought to be put upon

* Though moisture proceeding from the earth or ground is the most pernicious, yet every practitioner must have perceived very sensible effects on the constitution, from a raw, moist atmosphere, and during rainy weather. Thus, even in this country, the being exposed to moist easterly winds is very apt to produce agues and intermitting fevers, and especially to occasion relapses into such disorders.

the fore-mast, along which, the smoke from the fire-place might be made constantly to play and ascend. If the sail should occasion a little salutary smoke between decks, this inconvenience will be sufficiently compensated, by its keeping off the direct stream of the swampy shore effluvia, which now being obliged to form a curve before they reach the more distant parts of the vessel, must needs be greatly diverted and scattered.

At this season much depends on keeping the ship perfectly dry below; therefore, if the common fire-place be so situated, that the air between decks cannot be occasionally purified by its smoke, it will be proper to light wood fires to supply that defect, or in lieu of wood *junk* may be used, and burnt in an iron pot. Both should be first burnt a little in the open air, or previously dried in an oven, so that when carried below, the *Hatchways* may be suffered to remain shut for a considerable time. In this manner, a small fire in the great cabin, or between decks, will prove the best ventilator that can be used at sea; it not only purifies the air, but, even in a hot country, renders it cooler and pleasanter than before. Fumigations are also of service; the best is obtained from an equal mixture of pitch and tar.

Dur-

During the night it may be further necessary to keep a fire upon the *Fore-castle*, which would prove extremely beneficial to those who are on watch. These, together with the cold bath and bark, we recommend as the greatest preservatives of health in an unhealthy country.

The greatest sufferers in unhealthy harbours are the boats crews, and such, as being employed in the necessary business of wooding and watering the ship, are obliged to sleep on shore. That the men, on these duties, are so suddenly and universally seized with sickness, is commonly ascribed to their intemperance, or their being wet in the night with rain, from the insufficiency of their tents. But the truth is, it depends on their nearer approach to the unwholesome land-air, and especially their sleeping in it. This is demonstrable from the nature of the disease which seizes them, and which is very different from the effects of drunkenness, or of a common cold, and is constantly the peculiar epidemic disease of the country. One great means then of the safety of the men, which are employed on shore, would be to relieve them often, and to permit none to sleep in the tents. Centinels should be placed with a *Midshipman* at the watering place, and strictly

strictly charged to prohibit sleep; for in sleep, (a state of general relaxation) there is the greatest danger from the unwholesome air. This is a thing so well known at *Rome*, that, of its many inhabitants, there is scarce to be found one of the better sort, who, during summer or autumn, would venture to sleep a night at *Ostia*, or in the neighbourhood of the marshes adjoining to the city. Persons often recreate in the day, and hunt in the unhealthy parts of the *Campania*, but they are sure to return to the city before night; the fatal experience of many having sufficiently taught them the danger of sleeping in those nurseries of disease *.

* It has been an ancient received maxim, that to rise early, was greatly conducive to health. This, in a qualified sense, is true. The practice implies, regularity the preceding night; and, in dry and lofty situations, the propriety of this adage will the best appear. But woody, marshy, and low maritime places, with those subject to inundations, are manifest exceptions to the rule. The inhabitants of such districts, if they would secure themselves from fevers and other bad effects of their raw and uncorrected atmosphere, should wait the sun's appearance in, if not his advance above, the horizon, before they attempt the business of the field. To select a domestic instance, amidst a variety producible on this occasion, take that of a clergyman of long observation in such matters, who has assured me, that few of the farmers, reputed early risers in his parish, which is near the level coast of *Holderness*, live to be old. Defluxions on the breast and lungs, rheu-

In

In the year 1739, when admiral *Haddock* arrived with the fleet under his command in *Mahon* harbour, a midshipman and eight or ten men from each ship, were ordered to remain on shore, with the coopers at the watering-place, to refit and fill the water-casks. This watering-place was in a creek of the harbour, well known by the name of *English-Cove*. Here the men found a very large artificial cave, dug out of a soft sandy stone, sufficient to contain their whole number. Their bedding was directly carried thither, and it being in the summer-months, the agreeable coolness of the retreat was deemed by them all highly refreshing. But the consequence was, every one who slept in this damp place, were seized with the tertian fever, then epidemic in *Minorca*; of which not one in eight recovered. Most of the coopers belonging to the fleet, were at this time cut off by it; whilst at the same time, the men on board the ships,

matisms, agues, and the diseases of a debilitated *Tone* of Fibres, and slackened perspiration, are the evils entailed on their mistaken conduct.

In *Europe* the colour of the inhabitants gives the true indications of the healthiness of the soil. Thus in most places of the *Isle of Wight* the natives shew in their countenances the most visible tokens of confirmed health, compared with those who even inhabit the island of *Portsea*, but especially those in the fenny countries.

who

who lay close almost to the shore, were free from complaint. Others, who were ordered upon the same duty of watering the fleet, in the place of those who were taken ill, enjoyed likewise a perfect state of health, by being obliged to sleep every night in their respective ships. There are numerous instances of boats crews having suffered greatly by sleeping near the *Mangroves*, with which the sides of the rivers are frequently planted in the Torrid Zone. I have known the whole boat's crew seized next morning with bad fevers, and seen several men at *Haslar* hospital, whom the fever, thus contracted, had left in a dropical and irrecoverable bad state of health.

As for those who must of necessity remain on shore, and sleep in dangerous deserts and uninhabited places, some farther directions should be added for their use.— They must take care not to sleep upon the ground exposed to the dews, but in hammocks in a close tent, standing upon a dry sand, gravel, or chalk near the sea-shore, and where there is no subterraneous water for at least four feet below the surface of the ground. The door of this tent should be made to open towards the sea, and the back part of it, which receives the land-breeze, must be well secured by double
can-

canvas, or, covered with branches of trees.

But in such circumstances a hut, when it can be procured, is preferable to a tent, especially if it be well thatched, so as to prove a defence both against the excessive heat of the sun by day, and the noxious dews which fall at night. Here the men may be enjoined to smok tobacco. When the air is thick, moist and chill, the earth being overspread with cold dew, a constant fire must be kept in and about the tent or hut, as the most excellent means of purifying such unwholesome air, and of preserving the health of those, who either sleeping or waking, are exposed to its influence. The centinels who guard the water-casks, ought likewise at such a time to have a fire burning near them. All old and forsaken habitations, convenient caves, and natural grottos in the earth, where the men may be induced to take up their abode, must, before their admission, be perfectly dried and purified with sufficient fires; every person should likewise be made to observe the necessary caution of wearing warmer cloaths and coverings, as a defence from the chilling night air.

Let all, who value their health, also have recourse upon these occasions, evening

ing and morning, to a dram of the bitter infusion of the bark: or, if this cannot be procured, they may use a moderate dram of garlic-brandy. Exposure to the too great heat of the sun is carefully to be avoided.

Those seamen or officers who are employed on shore in unhealthful countries, may be allowed to indulge themselves in a more plentiful, though moderate use of vinous or spirituous liquors. In aguish, hot, and intemperate climates, a light dinner, but a more hearty supper, with a glass in the evening, will not be amiss, for such as have been accustomed to free living.

But fire and smoke being undoubtedly the great purifiers of all unwholesome or tainted air, and the most excellent preservatives against its noxious influence; I shall now endeavour to enforce the instructions I have given relating to them by examples and facts.

Here I must observe, it is the custom of the Negroes in *Guinea*, as also of some *Indians* (who both sleep for the most part on the ground) to have a fire, producing a little smoak, constantly burning in their huts where they sleep. This not only corrects the moisture of the night, but also, by occasioning more smoke than
heat,

heat, renders the damp from the earth less noxious. In all those unhealthful places, particularly during fogs or rains, a raw vapour, disagreeable to the smell, arises from the earth, and especially in the huts and houses; of which, however, a little smoke is the best corrector. On this subject I was favoured by the surgeon of a *Guinea* ship with the following relation.

The ship being up one of the rivers for the sake of trade, it was found to be very dangerous to sleep on shore; without which, their trade could not so conveniently be carried on. First the captain, then the mate, and two or three of the seamen were taken ill; each of them the morning after they had lain on shore. By these accidents the men were greatly intimidated from lying ashore; till the surgeon boldly offered to try the experiment on himself, which he did: next morning, when he waked, he found himself seized as the rest, with a giddiness and pain in the head, &c. He immediately acquainted one of the Negroes with his condition, who carried him to his hut, and set him down in the smoke of it; when his shiverings and giddiness soon left him. He then took a dram of the bark bitter; and found himself greatly

relieved, especially by breathing some time in the smoke. Thus instructed by the Negro, he ordered a large fire to dry the hut he slept in; and afterwards had every night a small fire sufficient to raise a gentle smoke, without occasioning a troublesome heat: and by these means, he, and several others, using the same precautions, slept many nights on shore without any inconvenience. The smoke was just sufficient to destroy the sensation of the raw damp vapour usual in such places.

But of all vapours which infest the torrid zone, the most malignant and fatal are the *Harmattans*: and as I do not remember to have seen them any where described, I shall in this place give an account of them. They are said to arise from the conflux of several rivers in the king of *Dormeo's* country at *Benin*; (the most unwholesome part of *Guinea*) where travellers are obliged to be carried on men's backs for several days journey, through swampy grounds, and over marshes, amidst stinking ooze, and thickets of mangrove trees, which are annually overflowed. These vapours come up the coast as far as *Cape Mount*, a surprising extent of country, with the S. E. and N. E. winds: and it has been observed, that, in their progress, they have often changed

changed both the course of the winds, and of the sea-currents. The times of their appearance at *Cape Coast* are, the months of *December, January, or February*. The N. E. and S. E. winds are always unhealthy, but particularly so during the *Harmattan* season. Some years this vapour is scarcely perceptible, but in others it is thick, noxious, and destructive to blacks as well as white people. The mortality is in proportion to the density and duration of the fog. It has a raw putrid smell, and is sometimes so thick, that a person or house cannot be discerned through it, at the distance of fifteen or twenty yards; and it continues so for ten or fourteen days; during which it opens the seams of ships, splits and opens the crevices of wood, as if shrunk or dried by a great fire, and destroys both man and beast. This was the case in the year 1754 or 1755, (I do not at present recollect in which) when this noxious stinking fog occasioned great mortality in *Guinea*. I have been told, that in several Negro towns, the living scarce sufficed to remove or bury the dead. Twenty women brought over from *Holland* by a new governor, to the castle *del Mina*, perished, together with most of the men in the garrison. The gates of *Cape Coast* castle were shut

84 *Precautions necessary, &c.*

up for want of centinels to do duty; the blacks dying at this time as well as the white people. The only means that could be used during this calamity, were firing guns in the castle, and burning every where pitched staves, and the like; the smoak of fire always giving relief. Several had recourse to going on board the ships in the road, where the vapour was less dense; and by the spreading of awnings, and kindling of fires, a ventilation was procured more easily on the water than on shore. It is lucky, that it is only in some years that *Harmattans* are so very thick and noxious, which would otherwise depopulate part of the country. It is observed that all fogs are extremely unhealthy in those parts, particularly before and after the rainy season; and during those times, the smoak of wood, pitched staves, &c. are found to be the most proper correctors of such an unhealthy air.

S E C T.

S E C T. XII.

Means of removing the land sickness.

Sickness from the land air removed by the ship putting to Sea. Articles of restorative diet, necessary for the sick. Of contagion in a ship.

WHEN sickness, by lying in an unhealthful harbour, begins to rage with great mortality amongst the men; to avoid the pernicious influences of the land air, the ship must immediately put to sea; there to seek and regain health, and the perfect recovery of the weak. This expedient has often succeeded. The most material point is, to take due care of the sick and weak that are brought on board. If they are immediately put on a gross sea-diet, they will soon either become bloated and dropical, or die in the flux; the latter being one of the most usual diseases of hot climates, as also the consequence of most others which occur there. I have been surprised to see so many men arrive from the *West Indies* reduced almost to skeletons by this disease. When a ship puts to sea with her men for the sake of health, a proper stock of the most light, nourishing,

86 *Means of removing the Land Sickness.*

ing, and restorative food, should always be carried out for those who are sick and weak; such as *Goats* for food, and milk, *portable Soup*, *Eggs* preserved, by stopping up their pores with grease; sago, and sallow, *Limes* and other *Fruits*, as also *Wine*, which is at all times greatly preferable to spirits of any sort, but more especially in the present case. By such means the sick will recover faster at sea than at land.

This is the sum of what I have to offer, as most likely to preserve the health of the men in his majesty's navy. But as it is proper to be provided against the worst that can befall, it is to be observed, that when malignant fevers, whether continued, remitting or intermitting, and fluxes make their appearance at sea, in close, hot weather, or are produced by the unhealthful air of a low, woody, marshy country; they are almost always to be suspected as infectious, more particularly the *Bloody Flux*, and then it is that the frequent mortality and the speedy progress of such distempers in a ship, are, for the most part, more owing to contagion, than to the influence of any other cause; the air being more vitiated from thence than it possibly can be by any other means. The cloaths, linen, beddings, and various utensils of the sick,

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are

are apt to imbibe and propagate contagion. The air of the sick apartment, when in a close unventilated place, becomes often so highly tainted, that I have known six attendants infected by it in less than twenty-four hours. Hence often proceeds the uncommon malignity and mortality occasioned by fevers, which we sometimes hear of in ships, there being instances, where a ship's company have suffered as much in proportion to their number, by a fever having acquired a high degree of malignity and contagion from polluted air, as any well-aired city would probably suffer by a visit from the plague, owing to a constant source of infection kept up in the ship, from the want of due precautions.

Thus it becomes a matter of the utmost consequence, to put in execution all proper methods for early stopping the infection, and spreading of such contagious diseases when they unfortunately occur in a voyage. To deliver a few rules for that purpose, was the second intended branch of this essay, to which I shall immediately proceed, after offering some means of relief in an unfortunate situation, which I have not yet mentioned.

S E C T. XIII.

Means of procuring wholesome water at sea.

Important discovery of rendering sea-water fresh by distillation. General benefits resulting from this discovery. Various methods of purifying bad water.

BAD Water is, next to bad air, a frequent cause of sickness, especially of the flux, in places situated under the Torrid Zone. Where the water is bad, the casks should always be filled with rain, when it can be done : or, where there is plenty of fuel on shore, the sea water may be distilled, which will prove as wholesome as that of the *Thames* *.

* The substance of a paper read before the Royal Society, being a letter from Dr. Lind to Mr. Robertson, master of the Royal Academy at Portsmouth, and F.R.S.

“ In revising my Essay on preserving Seamen, there
 “ occurred to me a distress usual to mariners, which is
 “ the want of good and wholesome water in many parts
 “ of the world at which they are obliged to remain.
 “ A calamity not indeed peculiar to seamen, but to
 “ many of our colonies and factories abroad, who are
 “ destitute of all other but the rain water. Whilst in
 “ other places, especially on the *Guinea* coast, the bad
 “ waters of the soil are justly suspected to occasion
 “ fluxes, the *Guinea* worm, and various maladies which
 “ infect those countries.

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If the water, on digging a pit in search of it be found foul and impure, the pit

“ In order to supply such places with a pure whole-
 “ some water, and with the least trouble, I have long
 “ meditated an application of the solar fire for distilling
 “ sea-water, upon the principle, that though it was
 “ made greatly to exceed that of any culinary or sur-
 “ nace heat, yet it would not melt any metal so long as
 “ water uncompressed was kept applied to its side; and
 “ that various contrivances might be made for retaining
 “ and diffusing it beyond the *Focus* of the *Speculum*.
 “ As both the glass and still should rest upon stands, no
 “ farther trouble would perhaps be requisite, than a
 “ person to attend to bring back the burning *Focus* to
 “ its proper line, when altered by the sun's motion,
 “ and even to save this trouble a proper apparatus
 “ might be thought of.

“ But previous to making any trials by the sun's heat,
 “ I began with distilling sea-water, and various ingre-
 “ dients, in order to fix upon such as would be least
 “ expensive, the most easy to be procured, and which
 “ would produce the purest elementary water.

“ I imagined that sea water distilled in Mr. *Appleby's*
 “ way, had a soft taste unnatural to water. And I
 “ found upon distilling the sea-water from soap-leys,
 “ chalk, lime, ashes, &c. that each ingredient com-
 “ municated somewhat of its peculiar taste and flavour;
 “ but in no distillation did the sea salt ascend in a
 “ greater quantity than I found by a diluted solution of
 “ silver in aqua fortis to be contained in the rain that
 “ usually falls here, near the sea, when the wind comes
 “ from thence.

“ Being able to draw no certain conclusions from the
 “ distillations I had hitherto made concerning ingredi-
 “ ents to which the preference should be given, for dis-
 “ tillling salt water fresh, and not having the convenience
 “ of using glass retorts, I ordered a small tin still to be

must

must be made pretty deep and large, and its bottom and sides covered with large

“ made, which should contain about two quarts of water, to be worked without a worm-tub in my study.

“ After properly cleansing this still, I drew off some of the purest rain water, which I reserved as the standard test of a new distilled water; or of any flavour that might be imparted by the distilling vessels. I then put some sea-water by itself into the still, which, to my great surprize, passed into the receiver, without having any mixture of *Bitumen* or sea salt, and, as I judged, equal in purity to rain water.

“ I tried it with a solution of salt of lead, but found that neither it, nor indeed any distilled water, discovers impurities with this solution, which is only proper to search for a *Selenites*.

“ I observed that when the still run flow, the sea-water then boiling gently, the water came over freer from sea salt than the rain water aforementioned.

“ I hope this discovery will prove useful, and I am,

“ S I R,

Haslar Hospital,
26 April, 1762.

“ Your most humble Servant,

James Lind.”

“ Having found that when sea-water boils, nothing ascends but a pure vapour, which when condensed by any simple means, is converted into an excellent pure and elementary water; no persons at sea, or even when cast away upon a desert island where there is fuel, will now ever perish for want of fresh water, if either they carry a still to sea, or can on shore make a contrivance for distilling simply the sea-water.

“ The common ship-boilers, by being fitted with a pewter still head, will answer all the purposes of a still at sea. The worm instead of being placed in an open

stones,

stones, and then a considerable quantity of clean dry sand and gravel may be

tub may be contained in a close cask. so as not to be affected by the ship's motion. The cold sea water should be poured into this at the top; and when it becomes hot, may either be conveyed into the still, or allowed to run off by a pipe fitted with a stop-cock. In case of a scarcity of water at sea, what satisfaction it must afford to be possessed of the certain means of exemption from insufferable thirst, misery, and a cruel death?

One would indeed think that the shocking situation and distress to which many seamen and passengers have been reduced for want of that invaluable blessing, good water, would induce all commanders of ships to be at the trifling expence of so simple a machine as this *Head* for their *Pot* or *Coppers*, which would enable them at all times to procure wholesome water both for themselves, their officers, passengers, or sick, in place of their usual corrupt and stinking water at sea. A daily supply of water may be also procured without any additional waste of fuel.

Thus, if instead of bricks, the *Fire-places* of ships had iron pots fixed in such a manner, that when the fire was at any time lighted to dress the victuals, the heat might be applied to the side of the iron pots constituting the side of the grates, and consequently the sea-water contained in them being put into a boiling heat, the vapour might be condensed by such a simple head to the pots as has been described. By this means, in the worst weather at sea when it is possible to dress victuals, a constant supply of fresh water for common drink may be obtained.

Having recollected that salt pork in ships, is always boiled in sea-water; as also salt beef in long cruises or voyages; and imagining, that if the *Head* of the *Pots*, in which those provisions are dressed, were close and tight, those salted hard meats might macerate

thrown

thrown into it; by which means the water will often become, in twenty-four hours, clear, soft, and wholesome.

and soften better, and there would be a considerable saving of fuel (as I found that sea-water boils with a less degree of heat than fresh, and water closely confined requires less heat and fuel to keep it at the boiling heat) I determined to make some experiments on this subject.

For this purpose I took a piece of ship salt beef, another of salt pork, and boiled each of them separately with salt-water, in a pot with such a still-head as hath been recommended at sea. I was much pleased to find, that when salt beef is boiled in sea-water, the condensed vapour from the *Pot* (for none of it was allowed to escape) affords an excellent sweet water, slightly tinged with the beef flavour.

The water got from pork boiled in sea-water, had a stronger, though not disagreeable flavour of pork.

When the beef and pork were sufficiently boiled and very fresh, the *Pot* was emptied, and some ship-peas put into it with that water only, which had been procured from the sea water in boiling the former flesh meats. This water was remarkably soft, and quickly softened, broke, and boiled the peas. In like manner I boiled some oatmeal with the same water which made excellent water-gruel.

Now as both the pease and gruel were dressed in the same *Pot* as the beef, with the *condensing Cover*, there was a surplus of fresh water, which originally came from the sea, and upon standing twenty-four hours, had neither taste or smell, but might serve either for a fresh boiling of peas, or for the use of the hogs, fowls, &c. in the ship.

The whole usual ship provisions were thus dressed without the use of any other but the salt-water, and an overplus remained of wholesome fresh water.

I am apt to think, that salt beef will freshen equally well when boiled in salt-water as in the fresh, provided

But

But if it still continues impure, let a small cask, with both ends taken out, be

the water is renewed by letting the brine occasionally run off by the cock at the bottom of the copper, and supplying its place with warm sea-water from the refrigeratory or cooler.

When the ship's provisions are to be boiled, for saving water in this manner, the pewter *Head* before recommended is to be used; and the cook must be careful in keeping his utensils very clean, and especially his coppers free from verdigrease. Distilled waters become much more palatable by keeping, and that got from the sea water will keep for many months sweet in clean vessels or casks. If all vessels, commonly used at sea for boiling on the fire, were furnished with such a *Head*, the double advantage, not only of saving much fuel, but a great quantity of water would be reaped. Thus, if the barley water, gruels, &c. for the sick, which are made with fresh water, be boiled in this manner, all the water which would otherwise be expended by boiling away, would then be saved; and nothing further is required, than that the *Pots*, or *Saucepans* be somewhat larger than at present used, because they ought then never to be filled above one half or three quarters full; and the cover must not be so tight, but that the cook may easily remove it at all times, either to inspect what is cooking, or to stir about such materials in the pot, as are apt to rise up, or boil over, but *Oatmeal* I find to be the only article of ship's provisions that does. The cook will soon learn what small quantity of fuel is necessary to keep such *Pots* boiling, and the trouble of a more constant attendance to prevent the boiling over will be fully rewarded, by saving two of the most important articles at sea, *Fuel* and *Water*.

As the evaporation from water is nearly as the squares of its surface, hence so much the wider the *Iron Pots* are made, which were before recommended for the sides of the *Grates*, the more fresh water will be obtained.

placed

placed within a larger cask wanting only the head; into both put some clean sand and gravel, so that the level of the sand in the inner cask be higher than the bed of sand in the intermediate space betwixt the casks, leaving sufficient room to pour in water: and in the outer cask a cock must be fixed above the sand in it, though beneath the level of the surface of the sand contained in the inner cask.

By this contrivance, the water poured into the inner or small cask, will sink through the whole body of sand in it; and passing also through the gravel and sand in the outer cask, will ascend. and run off at the cock. As the surface of sand in the inner cask, becomes loaded with the gross impurities of the water, it may be removed, and fresh sand added.

I have only to add on this subject, that it appears by some thermometrical observations published in the Appendix, that sea-water when at rest, freezes at ten degrees below the freezing point of fresh water on *Fahrenheit's* thermometer. Whoever then discovers a method of producing an artificial and constant cold to that degree, will be able to freeze sea-water, and consequently render it pretty fresh in the cakes of ice when thawed: having found by repeated experiments that though the ice of the sea-water is saltish, yet it contains much less salt than the water before it was frozen; and that cakes of ice formed by the spray of the sea upon the shore, on being dissolved, form a water perfectly fresh and potable.

For

For private use, the water may be strained through a large funnel, having its narrow mouth filled with a bit of sponge, above which is to be a layer of sand and gravel, covered with a piece of flannel, and over the whole another layer of sand. Care must be taken to change the sand, sponge, &c. as often as they are found to be loaded with the impurities of the water. By such means, pure and wholesome water may frequently be procured from bad wells.

Fresh water, tolerably good, has sometimes been obtained in the *West Indies*, by boring a cask full of small holes, and burying it in a pit dug in the sand or sea-shore, about ten or fifteen yards distant from the sea.

Sand and gravel are known to be fit for the purposes above mentioned; when water is poured upon them in a vessel, and after stirring with a stick, the same appearances follow as in moving the bed of a pure rivulet, *viz.* upon removing the stick, the particles of small sand instantly subside, and the water stands on their surface without having received any tincture.

Some toasted biscuits put into the water of the river *St. Laurence*, were found serviceable in preventing the bad effects of it in occasioning fluxes in *Sir Charles Saunders's*

ders's fleet. About four pounds of burnt biscuit were used to a hoghead of water.

I am informed that the troops in *Canada*, for the same purpose, mixed powdered ginger with the bad water, and found benefit thereby.

At *Senegal*, where the water is extremely unwholesome, unslacked lime has been used to purify it. But water cannot thus be purified in a ship, because I find that it must be exposed in a very wide mouthed vessel for many days, and sometimes weeks, before it loses the taste of the lime: much of it is also expended, by daily removing the scum; and it will sometimes require boiling.

The addition of a small quantity of vinegar is likewise very proper, as an excellent corrector of unhealthy water; or *Cream of Tartar*, as before mentioned.

I shall conclude this section with observing, that if any of the directions hitherto given, cannot be complied with by all the ship's company, on account of their number; they may notwithstanding be useful to many of the officers, and others who have proper convenience to execute them, and are desirous of preserving health and a good constitution, during their residence in an unhealthy situation, especially under the Torrid Zone.

S E C T.

S E C T. XIV.

Claim to the discovery of freshening sea-water.

The author's claim to the original discovery of freshening sea-water by simple distillation. Account of Dr. Poissonniere's having received a Pension in France, and Mr. Irving a reward of 5000l. in England from parliament, for the discovery, several years after it had been published by the author. State of the discovery when Mr. Irving began his experiments: his mode of distilling the water, by a large tin tube, wet with mops: his certificates and publications: a comment upon them: inutility of his proposed alteration.

THE general benefit that must result to navigation, from the invention of an easy method of freshening sea-water, will, I flatter myself, be an excuse for urging a short vindication of my claim to that important discovery.

It may perhaps surprise the public to find, that four years after the discovery of rendering sea-water perfectly sweet and wholesome by a simple distillation, had been made, as has been related in the preceding section, Dr. Poissonniere, a physician in France, had a very considerable pension set-

tled upon him on account of it; and that in the year 1772, ten years after my first publication of it, Mr. *Irving* also, on the same account, received the sum of 5000 *l.* from the British parliament.

Dr. *Poissonniere* pretended to no other merit, than that sea-water could be rendered perfectly fresh by a simple distillation; and it was above two years after I had made this discovery, before the doctor went to *Brest* and *Toulon* to make the proper experiments on the subject—but I believe the *French* themselves now give up the honour of the discovery to *England*.

In 1772 Mr. *Irving* obtained a grant of 5000 *l.* from the house of commons, for “the discovery of an easy and practicable method of making sea-water fresh and wholesome.” *Votes of the House of Commons*, p. 597. 11 March, 1772.

As the foundation of Mr. *Irving*'s claim may not be generally known, it will be proper to lay before the public the printed *Certificates* and *Papers* presented to the house, from which he received the reward; these compared with what I have said in the preceding section, and still more fully in an *Appendix* to my *Essay on the Diseases of Hot Climates*, will give a full idea of all that is hitherto known relative to freshening sea-water by distillation;

lation; and persons conversant in such matters, will from thence be enabled to judge of Mr. *Irving's* pretensions to a reward; but as many may be altogether unacquainted with the subject, we shall, for the benefit of these, give a short state of the discovery at the time of Mr. *Irving's* application to parliament; and then more immediately consider the merits of his proposed alteration in the mode of distilling the water.

It has long been pretty generally known that sea water, on being distilled, is deprived of its *Salt*; but as the distilled water has always a *Disagreeable Flavor*, many ingredients have been added to it in the still, to prevent a *Bitumen* from rising, which was supposed to have been contained in the water, and to have imparted the disagreeable taste: the consideration of the respective advantages of each ingredient, led me first to enquire into the qualities of sea-water when distilled alone; I then found this *disagreeable Taste* to be only that which is common to all newly distilled liquors, and that it quickly goes off on exposing it to the air. I repeated my experiments, and every repetition served only the more strongly to prove the inutility of making any addition and to confirm my opinion of the pu-

rity and wholesomeness of the distilled water.

This point being at length fully ascertained, I, in the year 1761, communicated the discovery to commissioner *Hughes*, resident commissioner of the navy at *Portsmouth*, and to Mr. *Robertson*, then master of the academy there, and made the experiments before them.

I afterwards transmitted a full account of it in a letter to the *Royal Society* in *London*, which was read before a numerous meeting in May 1762.

And, in the year 1763, in the second edition of this treatise, laid before the public the result of these repeated experiments on the means of obtaining good water at sea, viz. that the vapour or steam, arising from sea-water on being exposed to heat, was perfectly fresh, and, however collected, afforded a pure wholesome water. I shewed the mistake of former chemists to have arisen from the *burnt* taste acquired during distillation, which they supposed to depend on a *volatile Bitumen* in the water, to preserve which from the action of the fire many deleterious ingredients were added, with trouble and expence, and frequently imparted a disagreeable flavour to the water. I proposed a *Still* as the

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most

most proper vessel for collecting this vapour, but, at the same time, shewed how the coppers of a ship, fitted with proper *Still-Heads*, might answer all the purposes of a still; and drew several inferences from the discovery with respect to the saving of fuel and boiling of provisions in a ship: these, unaltered, are the subject of the preceding section.

In another publication, printed 1767*, after enumerating the several attempts that have been made to freshen sea-water, I further insisted on the advantages of this discovery, more strongly recommended *Still-Heads* to be fitted to the *Coppers*, and shewed that this distillation was attended with little or no inconvenience in a ship: I endeavoured to render the process of distillation familiar to every capacity; shewed that the little globules of water, which appear on the cover of a pot in which sea water is boiled, and which arise from the steam being condensed, are perfectly fresh; that when in want of a *Still-Head* these may be collected by inverting the mouth of a *Tea-Kettle* into a hole cut in the wooden cover of the *Copper* or *Pot*, and that the barrel

* See Appendix to my Essay on the Diseases of Hot Climates, first published 1767, and reprinted with some small additions, 1771.

of a musquet, passing from the spout of the kettle through a cask of cold water, would supply the place of what is called a *Worm* and *Refrigeratory* *; and that, even supposing a ship to be without a tea-kettle, the common *Hand Pump* might be made to supply its place, by being cut through obliquely, and joined so as to form an acute angle, one end of the tube being then inverted into the cover of the pot, the other fastened as above to the gun barrel. I examined the quantity of fresh water that could be thus obtained from sea-water by distillation, and found that *three* parts out of *four* could be in general drawn off fresh; and that by the improved methods of distillation, from a still of thirty-two inches diameter, 200 gallons of fresh water might be obtained in twelve hours, with the expence of only a bushell and an half of coals; so that three chaldron of coals would be sufficient to supply a sixty-gun ship, with a complement of 400 men, for two months, with half a gallon of water a day to each

* The *Worm* of a still is a small lead pipe, of a considerable length, running spirally through a cask of cold water; it receives the steam collected by the still-head, which in its passage through the numerous convolutions of the pipe is cooled or condensed into water. The *Worm-Tub* or *Refrigeratory* is the cask containing this pipe.

man. I lastly mentioned the superior purity * of this distilled water to that obtained from any river or spring; and in a scarcity of fresh water, recommended the dressing of victuals in the steam of seawater.

* The purity of this distilled water may be further evinced by the opinion of Mr. Cooksworthy, an eminent chemist at Plymouth, received in answer to some questions I gave him in the year 1768, a little before my last publication on this subject.

“ Distilled sea-water is freer from impurities than spring, river, or even rain water; in this opinion I am confirmed by experiments.

“ I think most river water, or even spring water, much more rain water, when distilled, must be somewhat purer than sea-water distilled, as this contains a small (indeed, very small) quantity of Spirit of Sea-Salt, of which I apprehend the others must be free. — Our water at Plymouth distilled is perfectly pure.

“ I could never discover any contents in distilled sea-water, but Spirit of Sea-Salt; and by the nicest trial, its quantity appears to be only one grain and a half in a gallon of the water.

“ The distilled sea-water will keep for ever; I have now some by me which never stunk in keeping, and is now an excellent well-flavoured water; having entirely lost the calcareous flavour. This water has been distilled for several years.

“ I formerly made some experiments on sea-water at the desire of Dr. Fothergill, and found that the contents of sea water, are the marine, or common salt, and the Sal Catharticum Amarum, or Epsom salt; and that the supposed Bitumen in salt water, to which its bitterness has been sometimes ascribed, is a mere imagination, there being nothing bituminous discoverable in it.

Such was the state of the discovery till 1771; when Mr. *Irving*, surgeon of the *Arrogant* man of war, then at *Portsmouth*, first entered on the distillation of sea-water. I received an invitation to be present at his first experiment in public, and found that instead of a *Still-Head* he made use of a *Large Tin Tube* about six or eight inches in diameter. This was bent for about a foot at one end, so as to enter into a hole cut in the cover of the ship's copper, exactly in the same manner as the head which I proposed might occasionally be made, by cutting the tube of a hand-pump through obliquely, and joining it in an opposite direction; the other end of Mr. *Irving's* tube was about seven feet long, and being kept constantly wet with *Mops*, served to condense the steam, in lieu of a *Worm and Refrigeratory*; in shape, the whole resembled much the funnel of a stove, having the crooked end inserted in the cover of the copper. With this apparatus he distilled, at two different trials, about three gallons of water in a quarter of an hour, from the copper of a seventy-four gun ship, viz. at the rate of twelve gallons an hour, and of 250 gallons in the course of twenty-four hours;

or 500 gallons, provided both coppers are employed *.

* "Copies of Certificates delivered to the Lords Commissioners of the Admiralty of Mr. *Irving's* method of rendering sea-water fresh.

"Pursuant to an order from rear-admiral *Buckle*, we whose names are hereunto subscribed, have carefully examined Mr. *Irving's* method of rendering sea-water fresh by distillation, and do certify, that eighty gallons of sea-water, did, in twenty-five minutes after being put into the *Arrogant's* copper, and a fire made, distil in the proportion of twelve gallons per hour into fresh water, perfectly well tasted, and of less specific gravity than the best spring water in this neighbourhood; it completely dissolves soap, and affords no *Precipitation* by adding a solution of silver in *Aqua Fortis*.

"Mr. *Irving's* apparatus consists of a single tube, between seven and eight feet long, which may be easily made of tin, or thin iron plates, and the distillation carried on without inconvenience to the business of the ships.

"We further declare to the best of our judgment, that this method is founded upon principles in distillation, new and hitherto not practised, and which we believe will afford great advantages to that art in general, as well as fully answer the end proposed of supplying ships with a sufficient quantity of sweet and wholesome water.

"Mr. *Irving* has communicated to us the whole of his process, which appears to depend on such simple and evident principles, that we apprehend the most ordinary capacity sufficient to carry it into execution on board of any ship or vessel whatever.

"Every ship's boiler or copper, though deemed as two, is in fact, but one large vessel, with a partition nearly in the middle, and although only one part, or boiler is in use at the time when pease or oatmeal are

The advantages expected from this apparatus, we were told, were a large flow

“ dressing, yet water must be kept in the other, to preserve its bottom: Mr. *Irving* takes the advantage of this latter circumstance, and has actually drawn off sixty gallons of fresh water, during the boiling of either of the abovementioned provisions; and by a strict examination of the cook and his assistants, no additional quantity of fuel was used. But in case of sickness, or where there is any absolute necessity of a greater expence of water than usual, Mr. *Irving* can, by employing both coppers, distil five hundred gallons of water in the space of twenty-four hours, and that with the same quantity of fuel as is required in the ordinary business of the ship for that given time.— And we are clearly of opinion, that, by an inconsiderable alteration of setting the navy-coppers, at a very small expence, according to a plan shewn us by Mr. *Irving*, there will be a considerable saving of fuel without any inconvenience whatever.

Signed,

“ James Lind, M. D. *Physician to Haslar Hospital,*

“ David Ramsey Kerr, *Surgeon to Plymouth-yard.*

“ J. Leffory, *Captain in the Royal Navy.*

“ J. Machison, *Master of the Arrogant.*

“ J. Caulfield, *Lieutenant of the Arrogant.*

“ By order of rear admiral Buckle.

“ We do hereby certify, that we have most strictly inspected into Mr. *Irving*'s method of rendering seawater fresh by distillation, and are well satisfied Mr. *Irving* has made us acquainted with the whole of his process, which is easy, simple, and most effectual for the purpose of supplying any ship at sea with a sufficient quantity of sweet and wholesome water, without any inconvenience whatever.

of

of steam, from its being less confined on account of the large size of the tube,

“ And we do further certify, that we have most carefully examined the water distilled, and find it freed of all salts, or other impurities, and preferable to any water here in use.

“ And we do further certify, that by Mr. Irving's method no waste of water ensues in boiling provisions for the ship's company: that we have tasted the water drawn from pease while dressing, and find it agreeable and wholesome.

“ Given under our hands on board his majesty's ship *Northumberland*, at *Spithead*, this 11th day of March, 1771.

“ John Bogue, *Surgeon of the Northumberland*.

“ Fred. Thomson, *Surgeon of the Tartar*.

“ S. Brown, *Surgeon of the Bellona*.

“ J. Hooper, *Surgeon of the Prince of Wales*.”

“ We whose names are hereunto subscribed, do certify, that we have attended *Doctor Charles Irving's* process for distilling sea-water, in order to render it fresh; and that upon a fair average, a gallon of fresh water was repeatedly drawn in three minutes and a half.

“ This operation lasted two hours and a half, with one of the *Centaur's* coppers, during which time the other was constantly boiling with the same fire, but we did not make any use of it, for want of an apparatus for that purpose.—From what we have seen, we are convinced that (at the abovementioned rate) seventeen gallons and a half of good fresh water, may with ease be distilled from sea-water every hour, till a sufficient quantity is obtained.

“ Given under our hands on board his majesty's ship *Centaur* at *Spithead*, this 4th day of January, 1772.

“ J. Bentinck, *Captain of the Centaur*.

“ Day. Maitland,

“ Richard Fowler,

} *Lieutenants*.

“ Ant. Stanley, *Master*.

“ Simon Brown, *Surgeon*.”

and its more perfect *Condensation*, from the evaporation on the outside being supposed to produce a greater degree of cold than could be obtained by passing the tube through cold water: the water was also expected to be purer, as the supposed *Bitumen* was thought thus to have a more ready means of escape.

We were informed, Mr. *Irving* had drawn off sixty gallons of water from one copper in about five hours, while the pease were boiling for the ship's company in the other, without any additional increase of fuel; a ship's copper being only one vessel, with a partition near the middle, so that it is always necessary when one part is in use, to put in water to preserve the bottom of the other; and were shewn that a considerable saving of fuel might be made, by moving the iron bars of the grate several inches higher up, nearer the bottom of the coppers, as, at present, great part of the heat of the fire is dissipated before it reaches them.

In the mean time, the company were amused with experiments, made on the distilled water by the *Hydrostatic* ballance, and solutions of lead and silver in spirits of *Sea Salt* and *Acqua Fortis*; though I urged, that repeated experiments had long since fully ascertained its purity.

Soon

Soon afterwards, Mr. *Irving* waited on me with the undermentioned certificate, which he begged I would sign. I at first refused signing it, objecting, among other things, to the words, has *actually* drawn off sixty gallons of fresh water during the boiling of *either* the pease or oatmeal; as the pease generally take up four hours in boiling, whereas the oatmeal to make water gruel, seldom requires an hour. As I observed two gentlemen had already put their names to it, I at length consented to sign it, desirous that in any form so important a discovery as the freshening of sea-water by distillation, might be introduced into general use; this, Mr. *Irving* said, he had reason to believe he could effect, if he obtained the certificate; and to me, it appeared a matter of indifference whether the distillation was performed by means of a *Still-Head* and *Refrigeratory*, as I had proposed, or by a *long Tin Tube wet with Mops*, as set forth in the certificate: in that particular alone Mr. *Irving's* method having differed from what I had before published.

I then gave Mr. *Irving* an account of most of the experiments I had made on the distillation of sea-water, and shewed him all that I had published on the subject; together with a few manuscript additions

ditions upon it, which I intended making to the second edition of my *Essay on the Diseases of Hot Climates*, at that time in the press: and, in favour of the purity and wholesomeness of the distilled sea-water, I produced not only my own chemical trials of the water and the letter from Mr. *Cooksworthy* above given, but also the experience of my family, who drank no other water at the table for upwards of twelve months.

At intervals Mr. *Irving* repeated his experiments, as will appear by the other certificates he laid before the house of commons; but, after having signed the first certificate, my attendance was never again asked.

The *Remarks* * in the note subjoined, published soon after the certificates were

* “ Remarks on the methods proposed for rendering sea-water fresh, together with Mr. *Irving*’s method, as now practised in the Royal Navy.

“ Previous to an account of Mr. *Irving*’s method of rendering sea-water fresh, and to the reports and certificates of the practice and its utility, it may not be improper to give a short detail of the experiments which had been formerly made by others, respecting this subject; pointing out, at the same time, the several disadvantages attending their processes, and the general causes which obstructed the desired success.

“ Though various attempts have been made to render sea-water fresh and potable, they have remained hi-

ob-

obtained, begin with depreciating most of the former methods proposed for the

“ therto entirely frustrated by the great objections against
“ every method of distillation which had been proposed
“ to the public.

“ Without entering into an account of the earlier experiments, it will be sufficient to take a view of such
“ as have been prosecuted with the greatest attention,
“ since nearly the middle of the present century.

“ The first of these was the process of Mr. *Appleby*,
“ published by order of the lords of the admiralty, in
“ the *Gazette* of June 22, 1754: by the account of
“ that process, it appears that Mr. *Appleby* mixed with
“ the sea-water to be distilled, a considerable quantity
“ of *Lapis Infernalis* and calcined bones. The highly
“ unpalatable taste of the water, however, exclusive of
“ the almost impossibility of reducing the process into
“ practice, prevented the further prosecution of this
“ method.

“ Another process of procuring fresh water at sea,
“ was afterwards published by Dr. *Butler*. Instead of
“ the *Lapis Infernalis*, and the calcined bones, he proposed
“ the use of *Soap Lees*; but though the ingredients here were somewhat varied, the water was
“ liable to the same objections with that which had
“ been obtained by the preceding experiment.

“ Dr. *Stephen Hales*, instead of *Quick Lime*, used
“ powdered *Chalk*; and introduced ventilation, by blowing
“ showers of air up through the distilling water,
“ by means of a double pair of bellows. It was found,
“ by this method, that the quantity of fresh water obtained
“ in a given time, was considerably greater than
“ what had been procured by the process of Mr. *Appleby*.
“ This invention, however, was subject to several disadvantages. The air-box which lay on the bottom
“ of the still, as well as the chalk, much obstructed the
“ action of the fire upon the water, at the same time
“ that the boiling heat of the latter was diminished by

dis-

distillation of sea-water. On what I had published on the subject, Mr. Irving ob-

“ the ventilation : so that more than double the usual
“ quantity of fuel was necessary to produce the same
“ effect. This method had likewise the disadvantage
“ of a very unpleasant taste in the water, and more
“ liable to contain salt in it, than the preceding at-
“ tempts.

“ The next who attempted any improvement was
“ Dr. Lind, at *Portsmouth* : he imagined that distil-
“ lation might be conducted by means of the solar rays,
“ applied through the medium of glasses to a still put
“ upon the deck, and a person to attend, to bring back
“ the burning focus to its proper line, when altered by
“ the sun's motion : *He also distilled Sea-water without*
“ *the addition of any ingredients* ; but as this experiment
“ was performed in a vessel containing only two
“ quarts, with a glass receiver, in his study, and it
“ does not appear, by the experiment, that the water
“ was either freed of salt or marine acid, no conclu-
“ sion whatever could be drawn from it.

“ In the year 1765, Mr. *Hoffman* introduced a still
“ of a new construction, with a secret ingredient ; but
“ the large space which this machine occupied, being
“ seven feet five inches, by five feet eight inches, and
“ six feet seven inches in height, rendered it extremely
“ inconvenient ; at the same time that, on account of
“ the shallowness of its form, the use of it was im-
“ practicable during any considerable motion of the
“ ship : the water likewise possessed all the disadvan-
“ tages common to the preceding methods.

“ About the same time, experiments were made
“ with a still of the common construction, and Mr.
“ *Dove's* ingredient. This method was attended with
“ no advantage over any that had been formerly used ;
“ the distilled water had likewise a most unpalatable
“ taste ; and the enormous size of the apparatus, which
“ occupied a space of thirteen feet seven inches, by six

serves,

serves, that " he (Dr. Lind, at Portsmouth) " distilled sea water without the

" six feet one inch, and six feet five inches in height,
" rendered it impracticable on board ships. An experiment was immediately afterwards made with the
" same still, but without any ingredient; the result,
" however, was uniformly a most unpalatable taste of
" the water.

" It is evident, from all the experiments above-mentioned, that no practicable method had yet been
" invented of rendering sea-water fresh and potable.

" The defects of these several methods may be reduced to the following heads :

" 1. The expence and inefficacy of ingredients.

" 2. The not separating the bituminous oily matter contained in sea-water.

" 3. The not knowing when to stop the distillation. Hence the water distilled until salt formed in the
" boiler, contained the acid of sea-salt, and likewise
" some vitriolic, with a quantity of magnesia sea salt ;
" there was likewise a portion of the substance of the
" still-head and worm dissolved in it.

" 4. The bottom of the vessel was soon destroyed.

" 5. The space occupied by the still, still-head, and worm-tub, rendered the use of them, in most cases,
" impracticable on board ships.

" 6. The quantity of fuel consumed, and the small
" quantity of water produced.

" 7. The expence of the apparatus, with the hazard
" of the still-head being blown off, and the inconveniencies arising therefrom.

" In order to understand clearly from what cause
" sweet and palatable water had not hitherto been obtained from sea-water, it is necessary to investigate
" the principles of which the latter is composed. Sea-
" water contains a pure sea-salt, varying in quantity

“ addition of any ingredients ; but as
 “ this experiment was performed in a

“ according to local circumstances : distilled water is to
 “ that at the *Nore*, as 1. to 1.0246 ; while that at *Spit-*
 “ *head* is much stronger. It likewise contains a mag-
 “ nesia salt, a vitriol salt, called Epsom salt, a gypseous
 “ earth suspended in the water, chiefly by means of
 “ fixed air ; an oleagenous bituminous matter rendered
 “ volatile by boiling ; and which ascending with the
 “ vapour in distillation, greatly vitiates the water, caus-
 “ ing not only much thirst and dryness on the palate
 “ and throat, but even exciting fever. Sea-water,
 “ when boiled down to a strong brine, admits with
 “ difficulty the evaporation of fresh water from it, con-
 “ suming more fuel and time than at first : the fluid
 “ being then strongly impregnated with salts, acquires
 “ a very considerable degree of heat, which forces up
 “ some of the salt with the vapour, at the same time
 “ the magnesia salt caking on the bottom of the boiler,
 “ a part of its acid is separated, which uniting with
 “ the vapour, likewise contaminates the water, while
 “ the copper is doubly injured by the excessive heat and
 “ the corrosion of the salt.

“ The merits of Mr. *Irving's* method of rendering
 “ sea-water fresh and palatable by distillation, are,

“ 1. In superseding the use of all ingredients, by
 “ means of a short straight tube, which having free
 “ communication with the air, the sulphureous bitu-
 “ minous oil, being more volatile than the vapours of
 “ water, passes off into the air, and leaves the water
 “ perfectly untainted with its noxious quality.

“ 2. In ascertaining precisely the proper limits of the
 “ distillation, so that the distilled water may not be
 “ contaminated by the acid of the salt, or the salt it-
 “ self ; and the vessel may be intirely preserved.

“ 3. In making the tube sufficiently large to receive
 “ the columns of vapour, as fast as they arise from the
 “ boiling fluid, so that there may be no compression on

“ vessel containing only two quarts, with
“ a glass receiver, in his study, and it does
“ not appear, by the experiment, that the
“ water was either freed of salt, or ma-
“ rine acid, no conclusion whatever could
“ be drawn from it.” I never did make
use of a glass receiver; but the disinge-
nuity of the whole assertion must be too
obvious to require a comment, to those
who have perused, in the preceding part

“ on its surface; whence the distillation is considerably
“ accelerated beyond what had been known in any for-
“ mer process.

“ 4. In the common boiler of the ship being used,
“ instead of the complicated apparatus of the still, still-
“ head, and worm-tub.

“ 5. In condensing the vapours by the simple means
“ of a mop wetted in water, and passed along the up-
“ per surface of the tube, so that it is kept cool, and
“ acquires no taint from the metal.

“ 6. In distilling as much water as is ever necessary,
“ with a very inconsiderable addition of fuel to what
“ is usually employed for the common purposes on ship-
“ board.

“ 7. In the peculiar construction of his hearths,
“ which serve at once to bake bread for the whole ship's
“ company, to distil water, and to do the ordinary of-
“ fices of culinary fire-places, with one fire, and with
“ no greater addition of fuel than what may be stowed
“ in less than a twentieth part of the space now occu-
“ pied by a ship's complement of fresh water; whence
“ not only a great expence is saved in cask, but room is
“ made for either provision or merchandize.

“ 8. In the facility of constructing the tube, which
“ may be made at sea out of any iron plates, or the
“ funnel of a stove, without any expence whatever.”

of this section, the state of the discovery when Mr. *Irving* first began his experiments.

My observations were not confined to speculation alone; I had not only tried every method there proposed, on large stills and coppers ashore, but many of them had been reduced to practice at sea. The *Dolphin* ship of war, in the year 1768, on her voyage round the world, distilled the sea-water according to the method I proposed; and though the people were but little conversant in distillation, and had no pecuniary interest in the success of the experiment, yet they obtained a much larger quantity of water, in proportion to the size of the ship, than Mr. *Irving* has yet been able to procure by means of his tube, with the utmost force of fire, with address in its management, and with the strongest motives for urging its success.

The defects of the several methods which had been before proposed of freshening sea-water are there enumerated, they are the expence and inefficacy of the ingredients—not separating the bituminous oily matter—not knowing when to stop the distillation—the bottom of the vessel being soon destroyed—the space occupied by the still, still-head, and worm tub—the quantity of fuel consumed—the expence of the apparatus.—None of these defects can
how-

however be ascribed to the method I proposed, which differs from Mr. *Irving's* merely in the addition of a *Still-Head* and *Worm-Tub* to the common *Coppers* of the ship: I proposed the addition of no ingredients; I have already shewn that no bituminous oily matter exists in sea-water; I desired the distillation to be stopt when three fourths of the water had been drawn off; the bottom of the vessel is thus no more injured than in common boiling; the space occupied by the still-head and worm-tub is scarce larger than what Mr. *Irving's* tube would occupy when used; the quantity of fuel is not greater than in Mr. *Irving's* method; and the expence of the apparatus is trifling.

The merits which are ascribed as peculiar to Mr. *Irving's* new method, are also common to both: we shall examine each singly.

“ I. In superseding the use of all ingredients, by means of a short straight tube, which having free communication with the air, the *sulphureous bituminous Oil* being more volatile than the vapours of water, passes off into the air, and leaves the water perfectly untainted with its noxious quality.”

In superseding the use of all ingredients, and shewing that the steam of sea-

sea water, however collected, is perfectly fresh and wholesome, I placed the principal merit of my discovery; this, however, he allows me. The *sulphureous bituminous Oil*, which it is supposed would escape from the use of a straight tube, we have endeavoured to prove is no where contained in pure sea-water. The burnt taste which this water has, on being newly distilled, first gave rise to the opinion of its existence, but that taste is common to all newly distilled liquors; even pure rain water, on being distilled, acquires a disagreeable flavour; it is also not permanent, but goes off quickly on exposing the water to the air. The water which Mr. *Irving* distilled with his tube, when I was present, had full as much of this burnt taste as any procured by a still-head.

“ II. In ascertaining precisely the proper limits of the distillation, so that the distilled water may not be contaminated by the acid of the salt, or the salt itself; and the vessel may be entirely preserved.”

I have, in the Appendix to my Essay on the Diseases of Hot Climates, desired the distillation to be carried no farther than to two thirds, or three fourths, of the water put into the still; the distillation may be continued considerably lower before

fore any acid or salt will rise, so as to affect the distilled water; but, as the sea water, from being diminished in quantity, becomes in proportion more strongly impregnated with saline matter, it will both require a greater quantity of fuel to force it into vapour, and be more apt to corrode the vessel.

“ III. In making the tube sufficiently
 “ large to receive the columns of vapour,
 “ as fast as they arise from the boiling
 “ fluid, so that there may be no compression on its surface; whence the distillation is considerably accelerated beyond what had been known in any former process.”

The theory, which introduced the use of this tube, is applicable both to the freshening of sea-water, and to distillation in general; it is founded on an established law in *Chemistry*, that the less the surface of a fluid is compressed, the more readily it will rise into vapours; and the more the steam is confined, the greater compression it will make on the surface of the boiling fluid: to avoid this compression, Mr. *Irving* makes use of a large tin tube, six or eight inches in diameter, and seven feet in length, instead of the *Still-Head* and *long slender Tube*, in common use. In distillation, however, two points are to be attended to, viz. to procure a sufficient

quantity of vapours, and to *condense* these vapours: Mr. *Irving* seems chiefly to have attended to the first; when the *large* tube is used, the quantity of vapours arising may, perhaps, be greater than with a *Still-Head* and *Worm*; but, it seems, they must be less perfectly condensed, as the grand end of distillation, the procuring a greater quantity of fresh water, has not been proved to be in the least promoted by this new method,

The *Dolphin**, a ship of twenty guns, in her

* An account of the water distilled on board the *Dolphin* ship of war, on her voyage round the world, received from the late Mr. *Hutchinson*, surgeon of that ship; the original of which experiment is deposited in the admiralty.

" Feb. 19. 1768. The vessel was charged with 56 gallons of sea-water, the fire was lighted under it at 7 o'clock in the morning; the water began to drop at 26 minutes after 8, and at 2 minutes after 9 o'clock it ran in a small stream.

" It was received in tubs, each of which contained three gallons and an half.

1 tub ran off in — 31 minutes.

2 ————— 32

3 ————— 34

4 ————— 25

5 ————— 22

6 ————— 21

7 ————— 23

8 ————— 22

9 ————— 25

10 ————— 23

11 ————— 25

12 ————— 30

12 tubs, or 42 gallons, 313 or 5 hours and 13 min.

voyage

voyage round the world, in the year 1768, (two years before Mr. *Irving* began his experiments at *Portsmouth*,) drew off in the common method of distillation, from only fifty-six gallons of sea water more than eight gallons an hour, for above five hours, and in part of the time at the rate of ten gallons an hour; so that, in the

“ Remained in the still after the above forty-two gallons were drawn off, thirteen gallons and an half of salt-water.

“ Fuel expended in the above distillation.

Wood	—	9 pounds.
Coals	—	69 pounds.”

Captain *Wallis*, in the account of this experiment in his voyage round the world, published by Dr. *Hawkefworth*, observes, — “ We also procured fresh water by distillation, principally to shew the captains of the *Indiamen*, and their officers, that upon an emergency, wholesome water might be procured at sea.—That which came off by distillation had no ill taste, nor, as we had often experienced any hurtful quality. I thought the shewing this experiment of the more consequence, as the being able to allow plenty of water, not only for drink, but for boiling any kind of provision, and for making tea and coffee, especially during long voyages and in hot climates, conduces greatly to health, and is the means of saving many lives. I never once put my people to an allowance of water during the whole voyage, always using the still when we were reduced to five and forty tons.”

In the first edition of these voyages, by an error of the press, 36 gallons only are said to be drawn off from the 56 of sea-water, instead of 42.

course

course of twenty-four hours, that one vessel would have yielded 240 gallons, or a gallon and an half of water for every person on board, the *Complement* of the ship being 160 men. Mr. *Irving* chose, as the subject of his experiments, one of the largest ships in the royal navy at that time in commission, the *Arrogant* (and afterwards the *Centaur*) each of whose coppers holds upwards of 200 gallons, and whose complement is 600 men: from this, in the experiment at which I was present, he drew off at the rate of twelve gallons an hour, so that none of her coppers would yield half a gallon of water, in twenty-four hours, to each man on board; though only a third in proportion of what was procured in the *Dolphin*. Indeed the certificates shew, that in a subsequent experiment, a gallon of water was repeatedly distilled from it in three minutes and an half, which is 410 gallons in twenty-four hours, being about three quarts to each man, or nearly in the proportion of one half of what the *Dolphin* received.

The common method of distillation by the *Worm-Tub* will also even sometimes yield a much larger quantity than what the *Dolphin* procured. In Mr. *Appleby's* expe-

experiments *, to prove that sea-water might be rendered quite fresh on being distilled *with the Addition of Ingredients*, six gallons were obtained in an hour from a still of only *twenty* gallons, which may be supposed equal to the copper of our smallest man of war sloops carrying *sixty* men; whereas Mr. *Irving*, from the copper of a seventy-four gun ship, carrying 600 men, could, when I was present, from eighty gallons of water draw off only twelve gallons an hour: from what quantity the seventeen gallons and an half were afterwards drawn off, is not mentioned, though the vessel would hold upwards of three hogheads. These two experiments may serve to shew how much substituting a *large open Tube*, as Mr. *Irving* proposes, instead of a *slender Worm Tube*, fails of being a real improvement in distillation, the quantity of water it yields bearing a great disproportion to what is obtained by the methods at present in common use.

How far it might be proper in general to give the steam a more free vent, by enlarging the worm, or pipe, in which it is condensed in common distillation, prac-

* Published in the Gazette of Jan. 22, 1752, and attested by the College of Physicians, and commissioners for victualling his majesty's navy.

tical chemists can best determine. Perhaps the condensation might be rendered equally perfect, by making the pipe thinner, so as more readily to transmit the cold, and by frequently renewing the water in the worm-tub, or by causing a constant stream of cold water to pass through it, which may be easily done at sea.

“ IV. In the common boiler of the ship being used, instead of the complicated apparatus of the still, still-head, and worm-tub.”

From my first publication of the discovery, I always recommended the common *Boiler* of the ship to be used, having it fitted with a *Still-Head* and *Worm-Tub*; this method of distillation we also look upon to be as simple and successful, as the method proposed to be substituted in place of it, viz. a *large Tube* wet with *Mops*; it is much more cleanly, takes up less room when used, and requires far less attendance, an object of consequence in merchant ships, who cannot always spare two idle men to be employed in mopping the tube.

“ V. In condensing the vapours by the simple means of a mop wetted in water, and passed along the upper surface of the tube, so that it is kept cool

“ cool, and acquires no taint from the
“ metal.”

Mr. *Irving* having shortened the length, and enlarged the diameter, of the tube in which the steam is condensed, in order to give the vapours a more free vent, found himself in a great measure deprived of the benefit of the common *Refrigeratory*, merely passing the tube through a tub of water, became insufficient to condense so large a body of steam in so short a space; he therefore had recourse to the cold produced by evaporation, and kept the outer surface of the tin tube constantly wet with *Mops*; it being found that fluids, when converted into vapour, produce a considerable degree of cold, which he supposed might be greater than would be obtained by passing the tube through cold water. This principle however failed, a considerable part of the steam escaped without being condensed, and it was afterward found by the ingenious Captain *Bentinck* of his majesty's ship the *Centaur*, that a much larger quantity of steam might be condensed, since near two gallons of water more in an hour might be procured, by passing a constant small stream of cold water along the outer surface of the tube. This was effected by enclosing the tube within an-

other of lead *, and throwing in by means of the fire-engine a constant stream of cold water at the upper end, while it ran off at a small aperture made in the lower end. This kept the place much cleaner than the *Mops*, which always made it wet and disagreeable, and, not only on account of the water spilt in mopping, but on account of the steam from the surface of the tube, required many attendants, and did not condense such a quantity of water as might have been expected in the common method of distillation, from a vessel of that large size.

In order more readily to communicate the heat, Mr. *Irving* makes use of a tin †, instead of a lead tube; but this is extremely liable to rust, and, on account of its shape, is very difficult to clean; so that it would be scarce practicable to use these tubes long at sea, without their communicating to the water a nauseous iron taste; as occurred in one of the experiments made at *Spithead*, before commodore *Arbuthnot*.

* Some have also proposed enclosing the tube in a canvas hose or pipe, and throwing in the water by an hand-pump from the deck above, while the lower end carried it off into the sea.

† This tube has of late been made of plates of copper, tinned, instead of the common tin used at first.

“ VI. In

“ VI. In distilling as much water as is
“ ever necessary, with a very inconsider-
“ able addition of fuel to what is usually
“ employed for the common purposes on
ship board.”

This proceeds from there being a necessity of putting water in one of the coppers, while the other is in use; distillation may therefore be carried on in one copper, while victuals are cooking in the other, without any extraordinary supply of fuel: it is an advantage common to both methods, as both make use of the ship's boiler.

“ VI. In the peculiar construction of
“ his hearths, &c.”

We shall pass over this, as being mostly foreign to the subject of distillation, and proceed to the last article.

“ VIII. In the facility of constructing
“ this tube, which may be made at sea
“ out of any iron plates, or the funnel
“ of a stove, without any expence what-
“ ever.”

The construction of the tube out of any iron plates is perfectly easy to a workman, provided with *Solder*, but at sea it will be difficult either to meet with *Solder*, or a person capable of using it. In small merchant ships, where a want of water most frequently occurs, it will be found
more

more easy to receive the steam in an inverted *Tea Kettle* applied to a hole cut in the cover of the pot; or by the hand pump cut through, and joined in an opposite direction, as I had before directed; and afterwards condensing the steam by means of the barrel of a musquet, passing through a cask of water. The tea kettle, or hand pump, and the gun barrel, being things which no ship can be without.

I have thus, in the few preceding pages, attempted to vindicate to myself the honour of a discovery, the most important that has of late been made in navigation; and to shew, that the alteration lately made on the method of distilling the water, is by no means such a real improvement, as the large reward the parliament last year conferred on the proposer of it, gave reason to expect; the principles on which it was founded are plausible, but fallacious, and in the result seem to yield a less quantity of water than might be obtained by the methods of distillation which I formerly proposed; so that the generosity of the parliament shews rather the importance of the discovery in general, than the merit of the alteration in particular.

I am afraid I may have been thought tedious in my examination of Mr. *Irving's* re-

remarks, but the delicacy of an author's fame, the only reward of his past toil, made me wish to appear explicit, and frequently (to obviate misrepresentations rather illiberal) I found myself obliged to descend to particulars, which brevity would otherwise have led me to omit.

The advantages of a method of freshening sea-water are not to be confined to those only who live on that element; the trader and the ship of war may indeed be peculiarly benefited by it; but very extensive advantages also result from it to many of our colonies; several of the *West India* islands, as *Antigua*, have no water but what is preserved in *Tanks*, from the rains, and that, in a hot season, is not only wholly dried up, but at all times quickly corrupts, and swarms with vermin; through the whole extent of *Guinea* the water is extremely unwholesome: to such situations the distillation of sea-water must afford the greatest relief.

At sea, especially in merchant ships, where a want of water most frequently occurs, we would recommend a small *Still-Head* to be fitted to the copper or kettle, with a *Worm* to condense the steam, both made of the usual metal, as being least liable to rust. The *Worm-Tub* may be small, as the sea-water in it

K

can

can easily be renewed, and the *Still-Head* should be so slender as easily to admit of being put in the middle of the *Worm-Tub*, or it may be formed of a large tube, in two joints, for its more convenient stowage; and thus the whole apparatus may be contained in a small cask. But at land, in places destitute of wholesome water, where there is plenty of fuel, Dr. *Hales's* invention of blowing a shower of air through the water while it is distilling, should also certainly be put in practice, as it adds, according to the doctor's account, near one half to the produce. The best means of distilling it on shore will be by a large *Still* with a constant stream of cold water passing through the *Worm-Tub* for the more perfect condensation of the steam; and the diameter or bore of the *Worm*, a little larger than what is commonly used, for its more free exit.

CHAP.

C H A P. II.

Means of stopping the progress of
contagious diseases when intro-
duced into a ship.

S E C T. I.

Apartment for the Sick.

*Ventilation, and a free circulation of air, be-
neficial. A place to be allotted for the sick
under the fore-castle, or in the gun-room,
in infectious diseases. Regulations neces-
sary for keeping the sick apartments clean.
Patients on recovery to be separated from
the Sick. Infected bedding to be destroyed.
Arrangement of the Sick.*

A Point of great importance, upon
which the recovery of the sick, and
the preservation of the whole, will in a
great measure depend, is having a well-
aired hospital or sick *Berth*, as it is com-
monly called in ships, appropriated for
the perfect separation of the diseased from
the healthy; between whom no common
intercourse ought to be permitted. Ven-
tilation, by whatever means procured, or
the free access of fresh air into a ship,

must at all times greatly contribute to general health ; but on this occasion becomes indispensably necessary, by affording a constant supply of fresh air to the sick, and a quick dissipation of their morbid steams. It is true, when once a contagious or pestilential fever has invaded the crew, the freshest air will not remove it ; but then proper ventilation may abate its malignity, lessen the mortality, which would otherwise be occasioned, and by carrying off and dissipating the contagious *Effluvia* of the sick, become a great means of preventing its further progress.—Another very material advantage, derived from a constant renewal of the air, is, that in many instances, this will prevent common fevers, attended with no great degree of contagion, from becoming highly infectious. A danger which is always to be apprehended, when there is a great and general sickness on board, as an infection may be quickly generated by the *Effluvia* of a number of sick people closely confined, and who are not kept properly clean in their linen, beds, and utensils, especially if they labour under fevers, fluxes, or other malignant diseases.

Let us reflect, that one man in health pollutes a gallon of air in a minute, and by breathing, renders it unfit for the purposes

poses of life. This is found to be the case, by those who dive under water, as well as by various other experiments, and evinces the absolute necessity of its constant renovation; but more especially to patients confined in bed, as there is not any thing more refreshing, than cool air to the parched lungs, or more essential to their recovery, in every species of disease*.

The place commonly allotted for the sick, is either the fore part of the *Gun-Deck*, called the *Bay*, which is the most damp and unwholesome part of a ship; or, what is nearly as bad, and very inconvenient, the fore part of the *Hold*. Both these confined places have too often proved a seminary of infection to the whole company. If the nature of the service would permit, whenever the dysentery, or other infectious disease, especially a malignant and petechial, or what is called the *Fail* fever, are apprehended, the most proper place for the sick in warm weather, or in a hot climate, is under the *Forecastle*. They might there be sufficiently defended

* Animals, even the most tenacious of life, and those whose existence is found to depend the least on air, sooner expire in air made foul, than in vacuo. Plants sooner suffer and droop beneath the influence of noxious steams, than in a want of this vivifying fluid.

from the rain or damps, by having canvas hung round them, or a partition made with boards; and by this means all the parts of the ship below would be kept sweet, clean and wholesome. If that situation should be apprehended too noisy, or deemed improper, from being the kitchen of the ship, or should be otherwise thought incommodious; it is to be recollected, that this advice is proposed only to take place on pressing occasions, in a hot and calm season, when no other device can be practised, or opportunity had, for separating the sound from the infected, with equal advantage. That it is both practicable in some ships, and has been of use, the following is brought as a proof.

In the year 1751, a ship of twenty guns in the *Mediterranean* was infected with a fever, which, in the course of four months, attacked seventy of her men; who were all, as is usual, subject to frequent relapses, whilst they lay below: but upon removing the sick under the *Forecastle*, the disease soon disappeared, and in that place they did not lose a man.

But supposing this place is at any time found to be inconvenient, from the number of the sick, or their incommoding the working of the ship, &c. the patients ought then to be removed into the *Gun-Room*,

Room, for the benefit of that salutary draught of air, which may be constantly procured them, by keeping open the *Gun-room-ports*. The objection of the greatest weight that can well be made against this step, is, the inconvenience which may arise from it to the officers who eat and sleep in that part. But how trifling must this objection appear, when offered against the most proper means of preserving their own, and many other lives? It ought to be considered, that the necessity of taking this method, will but rarely occur. Many ships continue for years as healthy in the *West Indies*, as they would in *Portsmouth* harbour, especially after being seasoned a little to that climate.

There is seldom occasion to remove the sick in a ship, from their proper beds, into one place; and it is done only, when their number is encreased, so as to make it inconvenient for other men to attend them when separate. After this step is first taken, and a proper *Berth* between decks, or in the hold, has been provided, where the ventilators and other means have been used, and yet, because of the daily encrease of the sick, the progress of the mortality, and the plainly contagious nature of the disease, more air, and a speedy removal from an infected *Berth*,

are found to be absolutely requisite ; I believe, there are few officers in the *English* service, who would not willingly quit their habitation in the gun-room, for the benefit and preservation of the men. And this is only to be done, until they arrive in port, and the sick are landed.

Let it be remembered, that if an infection is in a ship, officers have no security against it, by sleeping in the *Gun-Room* ; on the contrary, if they are permitted to have hammocks in the *Steerage*, they are there much safer. The absolute security of all on board does indeed entirely depend on a stop being put, without delay, to the progress of the contagion.

It is further to be recollected, that such well-aired places as the gun-room, by the methods hereafter mentioned, are much easier cleansed from all infection, when the sick are once removed, than the other more confined and constantly damp parts of the ship.

If it be still objected, that the *Effluvia* from the sick would, by means of the air entering at the gun-room *Ports*, be carried to other parts of the ship ; I answer, there is no danger of this, if the place and patients are kept sufficiently clean and neat. But effectually to prevent the least suspi-

suspicion of this inconvenience, a perfect separation may be made of the gun-room from the other parts of the ship, by a partition made with boards or painted canvass, nailed up. If, after all that has been said, the gun-room is not permitted for the use of the sick; an hospital in the *Bay* is to be acquiesced in, which ought to have air-holes or *Scuttles* cut on each side, as also a pipe of the ventilator, to be played when the weather will not permit the *Air-Scuttles* to be kept open.

Too much cannot well be said to conquer the prejudices of the ignorant, who are unacquainted with the pernicious effects of confining patients, labouring under a contagious disease, in a foul stagnating air. In such a case, the malignity of the fever hourly acquires strength from the pent-up steams of the diseased; and those morbid *Effluvia* are imbibed by all the surrounding materials, even the timber itself: from whence a strong source of infection is formed in such apartments, constantly emitting poisonous steams. In such a polluted air, and tainted apartment, the most powerful antidotes, and febrifuge remedies, lose their efficacy.

The attendants on the sick, the surgeon and his mates, cannot well escape, and are often, in their turn infected. Even those,
who

who at first have had the good fortune to recover, have no security against a relapse; their continuance in such a tainted air will almost certainly produce it.—More danger is doubtless to be apprehended to the sick, from breathing in an air polluted with their own and the *Effluvia* of others, than from any degree of cold, which can well be admitted by fresh air.

When a great number are crowded in the *Gun-Room*, they will require the ports to be open day and night, only it may be requisite to have canvas shutters, to prevent too much cold in bad weather. It is here taken for granted, that the patients are duly supplied at this time, with sufficient, clean, and, if necessary, warm bedding.

This apartment assigned to the sick, ought to be kept free from all incumbrances of chests and the like; as also from crowds of people. It must be washed every day with warm vinegar, sprinkling the sides of the ship, and the beams above the *Hammocks*. The utensils of the sick ought also to be washed or sprinkled with vinegar, especially the necessary-buckets, when the men are afflicted with the dysentery. In this case, the buckets, immediately after using, must be

be washed, and afterwards have warm vinegar poured into them.

For further security, frequent fumigation is also requisite, as a necessary means for the more certain purification of the tainted air. The fumes of camphorated vinegar, of nitre, of pitch, tar, and the like, will be found serviceable. But what I would chiefly advise, is to burn two or three times a day, in different parts of the ship, a small quantity of wetted gun-powder, secured in a proper vessel. But more of this hereafter.

What Dr. *Huxham* has recommended to several ships, and has been found very beneficial, is a decoction of chamomile-flowers, rosemary, gum, myrrh, roses, and camphire, in sharp vinegar. It must be kept boiling in a proper vessel over a stove made for the purpose, whence it diffuses a very strong and pleasant fume. Such fumes or smoke ought every day to be renewed, and their use continued as long as the sickness subsists *.

* I have lately observed again and again with pleasure, the excellent effects of strong fumigations, when repeated and persisted in for some time, to remove very bad infectious fevers from the prison-ships in *Portsmouth* harbour, and the *French* prison at *Forton*. For it is not to be expected that once or twice fumigating will destroy an infection in a ship or prison, where a number of persons are confined and sickly.

With

With regard to the sick much will depend upon their being kept as clean as possible: filthiness being a chief source of infection, and cleanliness an excellent preservative. The less cleanly may have their hands and feet washed with a little warm water and soap, or with vinegar. When their linen becomes foul and stiff with sweating, they ought directly to be shifted, and after fumigating such foul linen with the steams of brimstone, they should be soaked in vinegar, and washed. Dry fresh bedding is a great comfort to sick persons. Every bed, as soon as the patient is recovered so far as to be able to get out of it, should be carried upon deck, and there be well fumigated, aired, dried and beat by his mess-mate.

It is needful also that there be a recovery-place or *Berth*, into which the convalescents are to be soon removed, taking care that the cloaths and bedding be sufficiently cleaned and fumigated before their admission into it.

This regulation, enjoined by the commanding officer, ought to take place every day at noon, when the weather will permit, *viz.* That all empty beds in the hospital be carried upon deck and well-aired, and if needful, smoaked and dried. Some sailors, from a natural slovenly disposition, and

and others, from weakness, are apt to be very remiss in this point of cleanliness, which however ought not to be in their power to neglect. Such beds as are spoiled and rotten, must be destroyed, and supplied by issuing new ones to the men; as ought likewise the beds of all those who have laboured under the *Jail* fever, because the bedding in this and some other fevers, and, indeed, most substances of a loose, spongy texture, such as wool, feathers, &c. do strongly retain, and are apt to communicate the contagion afresh.

The sick are to be placed at a convenient distance from each other, so as not to be too much crowded. Those who have fluxes, putrid sores, scorbutic ulcers, and the like offensive complaints, are to be put in the best-aired place of the apartment; or rather removed into a separate place, under the *Forecastle* or *Half-Deck*. Such as are under a Salivation for Venereal diseases, are not to be admitted into the sick apartment. Nor is this place to be crowded with men, labouring under any slight complaint, or indeed any other disease, than the reigning epidemic one. Dead bodies ought without delay to be removed upon deck, and the bedding and body-linen of the deceased to be thrown
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142 *Preservations against Infections.*

into the sea. The best and sweetest water in the ship should always be reserved for the use of the sick.

S E C T. II.

Preservations against infections.

Approved method of purifying the air in general during infection. Necessary precautions for the security of the attendants on the sick.

FOR the thorough purification of the ship, fires made of dried wood sprinkled with any resinous substance, such as pitch, boiled turpentine, and the like, and moved successively into all the different parts below, have been found very beneficial. When these fires are brought near the sick, the *Ports* must all be thrown open, as too much heat has always been suspected of dangerous influence in infectious fevers; and therefore every method is to be used, during this operation, of keeping the men agreeably cool in their beds, whilst the rest are sent upon deck.

As wood fires, which I had formerly *

* *Treatise on the Scurvy*, Ed. 3. p. 186.

in the fleet, been found so effectual in preserving the health of the men, and in purifying a tainted air, it may be proper to relate their effects. The common observation is, that after a ship has been for some time in bad weather with the hatchways shut, the air below, notwithstanding all the means that can be used, is found to be close and disagreeable; doubtless from the damp *Effluvia* constantly emitted from the various contents: but after the purification by wood fires, or of burnt pitched staves, the heat of which goes quickly off with proper ventilation by the *Ports, Wind Sails, &c.* the air becomes quickly much cooler than before, and continues in all the lower and unventilated parts of the ship sensibly fine, cool, and pleasant for some days afterwards. Thus it would seem that fire consumes tainted air, and renders it cooler and fresher, after the extinction of the heat, by the purification of all damp and polluted substances.

This observation has been sufficiently proved by repeated experience.

The means, by which particular persons may best defend themselves against contagion, are next to be considered. A glass of the bark-bitter taken once or twice a day, will be found an excellent pre-

144 *Preservatives against Infections.*

preservative against sickness and infection. Or the bark itself may be taken either in substance or in extract; it is now the principal medicine used by the *Franks* or Europeans in Turkey, as a preservative against the infection of the plague. And I recommend it to all nurses and attendants on the sick at land, for their proper security against infection. We often observe a fever to run through a whole family, and even the next neighbours to become infected by it; the precautions here directed, together with the bark, are the best preservatives I know *.

For perfect security in an affair of such importance, where there is a strong infection, either at sea or land, the attendants, for their own preservation, must take care never to visit the sick when their stomachs are empty, the body being then in an absorbing state. The most eligible season is after a light breakfast of tea, or the like: a slice of toasted bread dipt in vinegar, or rather the bark-bitter, may be taken a

* At *Hasslar* hospital I have experienced a decoction of the bark very efficacious in preventing relapses into infectious fevers: but it will sometimes fail, when the patient commits great irregularities, or is exposed to strong infectious causes. However, this detracts no more from its general efficacy in such cases, than its failing sometimes to cure obstinate agues, as is well known to practitioners.

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very little time before entering into the sick chamber; and the mouth afterwards washed with camphorated vinegar, swallowing a little of it with the spittle. The nostrils may be stopped with a little lint dipped in the same vinegar, which I have often used in the hospital, in so small a roll as not to be perceived by the sick. A suit of cloaths which is reserved for the purpose ought then to be put on. And it is to be remembered that linen stuffs, especially waxed ones, are preferable to woollen cloths, &c. If convenient, at this time the sick-chamber should be fumigated by some purifying smoke. The effect of which will be, that to remove this smoke, some inlet of air will be opened, by which the chamber will become perfectly ventilated and refreshed. These precautions being premised (which need only be used in cases of the most dangerous infection, either in a house, ship, or hospital) a person may freely, and with confidence enter any infected place, or chamber, at the same time he should chew somewhat which may occasion him to spit often, and a little warm camphorated vinegar may be held at times between him and the patient, of which he may receive the steam; he ought also to dip his finger in the vinegar before feeling the pulse, and

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afterwards, if any disagreeable sensation remains. A sponge is not to be used on this occasion for wetting the fingers, or other purposes, at least not more than once in a place that is truly infected. After the necessary business is performed, upon going into another chamber, or into the fresh air, the mouth is again to be washed with camphorated vinegar, the little *Plugs* removed from the nose, the cloaths shifted, and the hands washed. As I have often had opportunities of visiting patients labouring under the most contagious diseases at *Haslar* hospital, and never was in the least affected; so I may venture to say, that if the above precautions are severally used, no great danger will arise from visiting cases of the most pestilential nature: but to return to the subject of infections in a ship. Vinegar and garlic, no contemptible preservatives, should at this time be served to the men, by way of sauce for their salt-meats. Furnishing them also with pipes and tobacco, and making them smoke freely, has been a method often practised with success in different ships.

It is observable, that the perspiration and sweat of the patient are infectious in many fevers, but above all the stools: the breath of a dying person is bad, and all fevers have been esteemed to be most contagious

tagious towards their latter end. Swallowing the spittle in infected places is justly deemed a means of sooner acquiring the taint; upon which account, neither the nurses, nor any one else, should be suffered to eat in the sick apartments of the hospital. The wine, before directed to be reserved for the use of the sick, will at such a season be found extremely beneficial, not only as the best medicine in certain stages of the fever, but as an excellent strengthener and preservative of those on recovery. All spirituous liquors moderately used, as also lemons, are good preservatives against contagion. Wine is perhaps inferior to none of these. If it is found inconvenient to serve the whole ship's company with wine, their allowance of punch (made as before directed) may be increased. Or, if this cannot conveniently be done, the nurses ought at least to be permitted such a quantity more than their ordinary allowance, as may be judged reasonable to prevent their sickness, without endangering their abuse of it.

A glass of wine, with the juice of half a lemon, and sugar, taken before visiting or bleeding the sick, I also recommend as an experienced efficacious preservative against contagion in infected places. It is usual with some, to prevent swallowing

148 *Preservatives against Infections.*

the spittle, to put *Tobacco* in their mouths when attending the sick; but those who are in constant use of chewing that plant, are apt to let down part of its juice with their saliva. I would advise such persons to use a slice of the root of *Calamus Aromaticus*, dipt in vinegar, and to spit often.

It will conduce much to the health of all the attendants on the sick, that they keep both themselves and their patients perfectly clean, and free from filth and nuisances; a rule of great consequence in a ship. If the attendants on the sick wore painted canvas-jackets, they would be less liable to carry about infection, and the like method should be taken with their linen, as has been directed for those of the sick. I must add, the most chearful and willing men ought always at such times to be preferred as attendants on the diseased; grief and fear, being experienced greatly to dispose the body to receive impressions, which mirth and gaiety might resist. Universal chearfulness, good humour, and entertaining amusements, with moderate exercise, should be enjoined and promoted by the officers on board. Great fatigue of body, irregularities of every sort, especially surfeits and drunkenness, as also long fasting, ought carefully to be avoided.

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It is a received opinion, that *Fear* is a cause of itself sufficient to produce, in certain dispositions, a bad or malignant fever. There are at least many instances, in besieged towns, where no other reason could be well assigned for the rise of malignant disorders, than the dejection of spirits, grief, and panic of the inhabitants, occasioned by the bombardment, and the apprehensions of a violent death from some sudden assault of the enemy. This much is certain, that such passions of the mind serve powerfully to propagate an infection, even the plague itself. So that on all such occasions, too much art cannot be used to animate, with hope and confidence, both the afflicted and the sound. Spectacles of horror are never to be exposed to the view of sick persons: those, therefore, who die, should be removed silently and privately out of an hospital to a proper place, where no idle spectators should be permitted to view the ghastly appearance. It is always to be remembered, that every ceremony that is observed relating to a corpse, makes a deep impression on the mind, especially of the afflicted and dispirited; and by such impressions the body is surprisingly affected.

If any should think that the many precautions I have mentioned are trifling, it

is for fear they may be thought so, that they are so particularly inculcated.

S E C T. III.

Of hospitals.

In cases of infection information of it to be sent to the hospital, before the sick are landed. Caution necessary in receiving men from hospitals during a general infection. Separate wards to be allotted for different diseases. Tents in the open fields recommended for the sick during a strong contagion. Conclusion.

DURING the rage of contagious diseases, hospitals become grand objects of attention, as according to the different manœuvres (if I may be allowed the expression) practised in them, they will serve either effectually to extinguish the contagion, or greatly to diffuse it, and heighten its malignity.

First, it should be ordered by a regulation in the navy, that when a ship arrives from a cruize or voyage, having either a malignant, or spotted fever, the flux, or any other disease on board, which is plainly contagious, that, in this case, the captain or surgeon should acquaint the physi-

physician, or surgeon of the hospital, with their condition, previous to the landing of the sick, that proper and distinct wards may be prepared for their reception.——

The ordinary method has been, that as soon as the ship is brought to an anchor, the sick are often sent on shore, in the first boats, to the hospital, and are dispersed into the different wards, according as the beds are found empty, without any information given to the surgeon of the nature of their disease, till he receives the sick ticket, which is carried along with them.

As I have hitherto endeavoured to support, by facts, what has been advanced, so I cannot but observe, that, for want of this proposed regulation, more than once it happened, during the late war, that a few men, put on shore from an infected ship, have introduced a contagion into an hospital; containing a thousand sailors — This was the case both at *Gibraltar* and *Mahon* hospitals, where the fever diffused itself so, as to endanger the inhabitants, and especially the garrison of the former place. Nay more, these hospitals became a seminary of contagion to the whole fleet, as was experienced in a very healthy ship, the *Kennington*, where, by taking on board but one recovered man from the hospital,

the fever was introduced, and afterwards exerted its contagion for six months.

I must add, sound healthy ships ought to be extremely cautious of what men they receive from infected hospitals, or sickly ships. For want of this precaution many have suffered. To produce one from several instances—I remember in the time of the late war, upon the arrival of a *Dutch* man of war at *Spithead*, from the *West Indies*, that two *English* men on board of her, petitioned that they might be taken out as being *British* subjects, and willing to serve in the *English* fleet. Their request was presently granted, and accordingly they came on board one of our ships, without having any appearance of sickness; but next morning one of them was found in a fever, and the other dead in his bed. This fever turned out to be highly contagious, and annoyed our fleet for some time afterwards.—I have mentioned this fact, to enforce the necessity of proper precaution, and to evince the importance of many directions which have been here delivered.

The other regulation is a consequence of the former, *viz.*—That, in all hospitals, there should be separate wards allotted for different diseases. As no man ought to be received into the hospital, with-

without the previous inspection of the surgeon, so it must be his business to appropriate places to each; and in case of the arrival of a ship, with a contagious fever on board, as above mentioned, he is then to prepare distinct wards for the reception of the men; and to use all proper methods, for preventing the contagion from affecting the rest of the sick.—Many precepts for this purpose have been already delivered, so that I shall only say, the fever-wards in an hospital ought always to be the best aired; and, where the contagion is eminently malignant, spacious tents, or separate huts with fire-places, built in the fields adjoining, are greatly preferable to any close ward or apartment, for dissipating infection, and for the recovery of the patient.

When a malignant fever, in the late war, was brought from *England* into the hospital at *Mahon*, the house being found insufficient for the reception of so great a number of patients, tents were erected in the fields for many of the men. These poor men were thought to be badly accommodated, but it was observed, that most of those, who lay in the tents, recovered; when the mortality in the house was so great, that in some wards, not one
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in three escaped. This occurred in a hot climate, and in summer.

Thus I have drawn a picture, at full length, of the mischiefs that may possibly flow from want of due care and circumspection, with a view to excite the attention of such as might be negligent in matters of so serious a concern. The province has been mine to deliver precepts; the power is in others to execute; and if the expedients proposed, are thought by some, either too numerous or troublesome, let it be remembered, that to oppose the various evils to which our fleets, and consequently the safety of these kingdoms, stand exposed, we should, with united efforts, attempt to obviate every inconvenience which may tend to spread contagion and strengthen disease. For notwithstanding every assistance which human art can afford, the unavoidable accidents of noise, motion, crowded numbers, and the comparative want of accommodations, will ever render indisposition aboard a much greater calamity than a-shore. Hence the necessity of giving these precautions, and of being so circumstantial and minute.—But it is full time to close these scenes, and turn to what may afford comfort and encouragement.

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The seamen, on board his majesty's ships of war, have not only a fuller and more wholesome diet allowed them, than in any other service, but also an excellent provision of all the most proper necessaries for the sick.—Their surgeons, in general, are now well qualified; and the sick have at all times a sufficient number of careful attendants, to administer due assistance in their distress. They are likewise commonly less crowded with men, than foreign ships of war; and in every respect better provided with assistance, and all the necessary comforts in sickness, than merchants ships can possibly be.

In the merchant's service, the condition of the poor mariner, when at sea, is often much to be pitied, where he is destitute of proper advice and assistance, and even of such necessaries as might afford a present momentary relief, and render his affliction more tolerable.—In many cases, when in harbour, the men are obliged to expend a great part of their wages for a cure; which, in his majesty's service, they might have completed by some of the most able physicians and surgeons without expence. This is an encouragement beyond what some other nations give; for those who are in the French king's ships (if I am rightly informed) have all their
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pay stopped, when in the hospital, or under cure.—Nor is it a small additional pleasure to a seaman in the royal navy, to reflect, that whatever misfortunes, incident to his way of life, may befall him in the service of his country, he will be honourably rewarded, and, under many circumstances of but small accident, obtain a pension for life.

APPEN-

A P P E N D I X.

Cautions with respect to bleeding in hot climates.—Comparative degrees of heat and cold in different latitudes.—Cases of 5743 seamen received in two years at Haslar hospital.—Prescriptions adapted to most of the diseases incident to seamen.

HAVING had occasion already to observe, that blood-letting, by way of prevention from diseases, on passing the tropic of Cancer, was an usual practice at sea*, it may not be altogether foreign to the purpose of this Essay, to subjoin a few general remarks on that operation, for the benefit of those, who never practised in the torrid zone. The observations may perhaps be found the more necessary, as unexperienced practitioners are apt to imagine the principles they have been taught, relating to diseases in *Europe*, may

* In Chap. i. Sect. x.

serve for invariable rules of practice in all other climates.

It was before observed, that a transition, especially if quick, from cold to extreme hot weather, generally induces a *plethoric* disposition. The signs are, a pain and giddiness of the head, a heaviness and dullness of the eyes, which sometimes appear slightly inflamed; there is usually a sense of fullness and weight in the breast, the pulse being quick and oppressed. Some, at this season, are seized with fevers; a few with fluxes. In such cases, blood-letting is plainly indicated.

But the case is quite different, after a longer continuance of sultry weather, and when the constitution is in some measure habituated to the hot climate. For it is then observed, that the symptoms of inflammations in the bowels, even the most dangerous, are not near so severe in such climates, as in cold countries; nor can the patients bear so large evacuations. The practitioner, however, is not to be misled by the mildness of the symptoms; for he will find, notwithstanding such deceitful appearances, that the inflammation makes a more rapid progress in hot countries, than in cold; *Suppurations* and *Mortifications* being much more suddenly formed; and that, in general, all acute distempers
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come sooner to a *crisis* in the southern than in colder regions. Hence it is an important rule of practice in those climates, to seize the most early opportunity in the commencement of all threatening inflammations, to make frequent, though not copious, evacuations by blood-letting. For, by delay, the inflammation swiftly passes from its first to its last or fatal stage; at least an imperfect *Crisis* in such inflammatory fevers ensues, which fixes an obstruction in the *Viscera*, extremely difficult to remove.

It is indeed a general maxim with some of our *English* physicians in the *West Indies*, that, in most acute distempers, bleeding in that country is prejudicial. This is founded upon a supposition, that the *Craefamentum* of the blood is thinned, and the solids greatly weakened by the heat of the climate. So, say they, when a person is seized with a fever bleeding in such a habit of body, by weakening the powers of nature, withdraws that strength which is requisite to support the patient until the *Crisis* of the fever. The reason is partly just; yet, like a general maxim, will admit of many exceptions.

First, with regard to sailors, it is to be remembered, that they are more exposed to quick vicissitudes of heat, cold, damps, and

and to various changes of the air and weather, than most of the other inhabitants in the torrid zone. Add to this, their intemperance, and the excesses of every kind which they are prone to fall into, whenever it is in their power to commit them; all which render them more liable to inflammations, than any set of people. Hence their diseases require more plentiful evacuations than the land inhabitants in those parts of the world, and, generally, they bear them better.

This rule also, as I before observed, does not take immediate place in those, who are newly arrived in the torrid zone. The unusual heat not only relaxes the fibres, especially at the surface of the body, but is found greatly to expand the blood, and the other fluids. A proof of which, is, that young persons are often subject, upon their first arrival, to a bleeding from the nose.

But with regard to the natives, or those who have remained long in the country, we grant the custom of bleeding them but sparingly to be extremely proper, making a small allowance for the different seasons of the year, the temperature of the air, and the situation of the places where they reside. Thus, in some parts, even on the island of *Jamaica*, at particular seasons, the

the weather is cool; wherefore, in these places, and at such seasons, the inhabitants (having their fibres more rigid, and a more *compacted* blood) bear much better the loss of that vital fluid.

An opposite method to that of the *English* is pursued by the *French*, but more especially by the *Spanish* and *Portuguese* physicians in those countries. The *French* bleed too freely, and have recourse to the operation in almost every acute distemper; from whence dropfies and great relaxation frequently ensue, the common and fatal consequence of such customs, and of profuse evacuations in those climates. The latter not only follow indiscriminately the example of the former, in this particular, but are solicitous to contrive the most cooling remedies for all diseases, whether *acute*, *chronic*, or what are commonly termed *nervous*. Whereas, in many cases classed under the two latter denominations, warm, aromatic, invigorating remedies ought to take place, as much, if not more, in warm, than in colder regions: and such medicines are still more indispensably requisite in weakness after any acute disorder.

In cold countries, the state of the air greatly assists in restoring the impaired spring of the fibres; whereas every thing

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almost in warm weather, such as heat, moisture, &c. concur to relax and weaken the habit of body. Thus, we may daily see persons in *Britain*, after having suffered a most severe fit of sickness, recover their strength and spirits in a few days, and, in a very short time, their natural constitution. But the case is very different in the sultry regions of the torrid zone, or indeed in any part of the world whatever, where the heat of the season causes the mercury to stand for a length of time, at the 77th degree and upwards, of *Fahrenheit's* thermometer. During such an excess of heat, debility after fevers is apt to remain with *European* constitutions for several months. In *Jamaica*, the convalescents are sent to the cool summits of the mountains; but a retreat to a more northern climate is often absolutely necessary to recover their wonted tone and vigour of body. It is an acknowledged observation, that the *Negroes* and *Aborigines* in the torrid zone cannot bear too plentiful evacuations by the lancet.—They commonly mix the most stimulating, poignant spices with their ordinary light food, and this is found by experience suitable to their constitutions.

If indeed we may be allowed to assume it as a principle, which observation does
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in many instances verify, that in all countries, Providence has wisely ordered a provision of the most proper remedies for their peculiar diseases, we cannot here but remark, that most part of the native medicinal productions of the *Indies*, are of the warm aromatic kind; such as *Ginger*, *Contrayerva*, *Guaiacum*, *Winters-Bark*, *Pepper* of many kinds, and spices almost of every sort, together with *Camphire*, an excellent medicine in hot climates, and that grand febrifuge, the *Peruvian bark*, the most powerful strengthener and restorative of enfeebled, languid constitutions, and the only specific yet known for the malignant diseases of those climates.

Comparative degrees of heat and cold in different latitudes.

SEveral observations have been made of the different degrees of heat in various latitudes, and the most accurate with *Fahrenheit's* thermometers.

But I have been surpris'd to find how much those instruments, though made by good artists, differed from each other. For which reason I have often thought that the comparative degrees of heat and cold in different places, would be best as-

certained by observations made with the same instrument.—I therefore sent the same *Thermometer* abroad with careful persons; and by it measured the degrees of heat and cold from within 10 degrees of the north pole to *Jamaica*.

This instrument has been in my possession 14 years; I was obliged to correct its erroneous printed scale, so as to fix the point 32, by many repeated experiments, precisely at the degree of cold, in which a tea-cup full of water begins in 5 minutes to freeze when the wind is dry and northerly. And I then found that there were but 23 degrees of tube left before the mercury sunk quite into the ball: owing to a fault in the making. I afterwards adjusted the degrees ascending from 32, as nearly as I could by the boiling water heat of 212 degrees; when the mercury in the *Barometer* stood in a middle station.

According to this correction of the scale, I found 61 degrees (that is 29 above the freezing point) to be the usual and true mean of agreeable warm summer weather in *England*, during the months of *May* and *June*, and when a fire in the room was intolerable to people in health.

54 was the usual degree of heat within doors, in the warmest days of winter; and

A P P E N D I X. 165

and then I could either read or write in my study, without a fire: but when the temperature of the air was under 54, a fire became requisite.

The lowest, in six years observations, I found the mercury ever to sink at *Edinburgh*, during the severest frosts, and when exposed all night out of a north window, in the open air, was to 23 degrees, on the 3d *February*, 1757. But in most winters it seldom fell lower than 25 or 24 degrees and it was then intensely cold.

The severest cold experienced in four winters at *Haslar* hospital, was on the 14th *January*, 1760. On that day the mercury within doors fell to 29 degrees: water at this time freezing hard when kept in the same room.

The instrument being placed in the open air, that night at 12 o'clock, it stood at 22 degrees; which was the lowest I ever observed. And at this time the seawater stagnating in ponds, became covered with thin ice.

During the years 1758, 1759 and 1761, there was no such extraordinary degree of cold at *Haslar*, during the greatest cold the mercury stood at 25 or 26 degrees.

At *Edinburgh*, in the warmest weather in *June*, *July*, and *August*, the mercury was commonly at 70 in the middle of the day,

day, and 64 in the night. But during uncommon heats, it has risen to 73 and 75, perhaps once or twice in a year, and sometimes not in two years. The greatest heat observed by the instrument there was on the 12th *July*, 1757, when in the middle of the day, and well shaded, it mounted to 80 degrees. The heat was then quite stifling.

At *Haslar* I found in the usual heats in summer the mercury was about 2 degrees higher than at *Edinburgh*. The hottest day I ever felt here was the 22d of *July*, 1759, when the mercury in the instrument at noon, in the open air, mounted to 81 degrees, and in my room, with all the windows and doors open till 10 o'clock at night to 75.

Many *West Indians* thought the heat this day as great as they had felt in the *West Indies*. At noon there was no sitting in a room without having all the windows open, and a shade from the sun.

The same instrument, from which those observations were taken, was sent to *Greenland* with Mr. *Rannie*, now surgeon of a man of war, and in the latitude of 80, the mercury sunk quite into the ball, and so must have fallen to 9 degrees, but how much below that cannot be ascertained. Now supposing it to have fallen only to 9, then the cold in that latitude surpassed the

A P P E N D I X. 167

most severe frost that I had observed at *Edinburgh* or *Haslar* by 13 degrees. And as with the hardest frost in *Great Britain*, I never saw the mercury fall lower than 10 degrees under the point, at which water freezes; there it fell 23 degrees below it.

When the *Greenland* ship was in more southern latitudes, but still among the ice; the mercury in the instrument in the great cabbin stood at 31, and when brought upon deck fell to 25 or 22 degrees: which was the common temperature of the air during the summer in that icy sea, when the sun did not shine forth.

The same thermometer, in the year 1752, was sent to *Jamaica* with a judicious person, who touched at *Cork* in *Ireland*, and made the following observations: the instrument being placed on the outside of the cabbin window, and secured both from the direct and reflected rays of the sun.

	Degrees highest.	Lowest.	Mean or common Heat.
20 Jan. from <i>Cork</i> Lat. 51 : 49 }			
27 Jan. to Lat. 41 : 44 }	58	46	54
1 Feb. to Lat. 31 : 40 }	64	54	59
7 Feb. to Lat. 21 : 40 }	72	61	63
13 Feb. to Lat. 16 : 40 }	77	67	72
24 Feb. Keeping in Lat. 16 : 40 }	81	74	77
till the ship arrived at <i>Jamaica</i> }			

In *Port Royal* harbour on the 24th of *February*, and for some days following, till the observer fell sick, in the common heat of the day the mercury stood at 79 or 80 degrees.

In the year 1761 this thermometer was sent in the *Stag* man of war to the Streights of *Gibraltar*.

The lowest the mercury fell there on board of the ship, during the months of *June* and *July*, in which the observations were taken, was on the 20th of *June* in *Gibraltar* bay to 64; and the lowest at land was on the 12th of *June* in *Gibraltar* to 73.

The highest it ever rose on the fairest trials in the shade, was the 4th of *July*, at *Oran* in *Africa*, to 86; and at *Gibraltar* on the 16th of the same month, to 90. But the highest degree it ever reached on board the ship was 78; and by several accurate observations it appeared that the heat at land in *Gibraltar* exceeded that in the ship upon the water, by 8 or 10 degrees; and at *Oran* by 6; and that the common heat during summer in the garrison of *Gibraltar* is from 79 to 87 degrees.

From these accounts it appears that the heat in *Gibraltar*, on the 16th of *July*, exceeded the most extraordinary heat felt in *England* for 14 years past, 9 degrees; —and

—and that the usual summer heat there exceeds that of *Britain* 16 or 17 degrees.

But the highest the mercury ever rose on the water in *Gibraltar* Bay, in *June* and *July*, was to 78; and the common heat on the water in *Port Royal* harbour in *February* being 79 or 80; hence the summer heat in *Gibraltar* bay was not quite so much as in the month of *February* in *Port Royal* harbour. Though perhaps the heat on shore at *Jamaica*, in the winter month of *February*, was nearly equal to the summer's heat at *Gibraltar*.

By perusing a very exact thermometrical diary, kept in the *Montague* man of war, when in the *West Indies*, and adjusting the instrument to the corrected scale of my thermometer, I found that from *May* 24, to *August* 25, *Anno* 1760, the heat in the open gallery of that ship had never been less than 75 degrees, nor exceeded 88; and if we allow 6 degrees of greater heat at land in *Barbadoes*, *Antigua*, *Guadalupe*, &c. where the ship was stationed, the greatest summer heat in those islands will be 94 degrees, which approaches to within 2 degrees of the warmth of blood, which circulates through the heart of a man in health.—And to this temperature, the water,

water, as also all other fluids, together with the earth, and all the solids, in those *West Indian* islands, were then heated when in the shade, viz. 62 degrees above the cold with which water becomes a solid, or is converted into ice, and 118 degrees below the heat of boiling water, exceeding the greatest heat experienced by my thermometer in *Britain*, for 14 years past, by 13 degrees.

Cases of 5743 Seamen received in two Years at Haslar Hospital.

AS some have imagined the diseases of seamen to be different from those who live at land, I have here subjoined an abstract of the distempers of all such seamen as were received into *Haslar* hospital for two years, viz. from the first of July 1758, to the first of July 1760; the number of such patients being 5743. Of these, 2174 were afflicted with *Fevers*, 1146 with the *Scurvy*, 360 with *Consumptions**, 350 with *Rheumatisms*, 245

* Of these 360 consumptive patients, the disease in one fourth of them was owing to a cause well deserving attention. It proceeded from falls, bruises, strains, or hurts affecting the trunk of the body, and which often gave no great uneasiness for one year, or perhaps two;

with

with *Fluxes*. These are by far the most frequent and fatal diseases in the royal navy. Besides which, seafaring people are subject to other common diseases. During those two years, there were also received 10 for the *Angina*, 3 for the *Apoplexy*, 40 for the *Asthma*, 67 for the *Ague* or *Intermitting Fever*, 80 for pains or old hurts, &c. 20 *Chachectic*, 5 for the *Chincough*, 10 for *Colics*, 24 for the *Dropsy*, 6 for *Deafness*, 30 for the *Epilepsy*, 30 for various

and the cause lay concealed till after death, when in the bruised or hurt part (either within or without the cavity of the breast) I often found large collections of *Matter* in bags, at other times the parts were *scirrhous*, and always diseased. For a cough, with other concomitant consumptive symptoms, as I have discovered by dissection, does not always argue the mischief to lie in the breast, but are the signs of a weakened, drooping, and wasting habit.

Daily viewing so many piteous consumptive objects, I have often reflected on the barbarity of severe cudgeling, boxing and bruising among the vulgar; as also beating on the trunk of the body with a heavy stick; where, though the smart of the blow soon ceases, a foundation is often laid for an inward complaint, becoming mortal some years afterwards, of which I have seen many instances.

The death of a prince of amiable memory, is said to have been owing to the violent stroke of a tennis-ball; which gave no great uneasiness for some time after received.

Let it be remembered, that the human machine is of too delicate a texture, to bear rude shocks or bruises; and that the injuries of its inward solid parts are the most irreparable.

dis-

disorders of the *Eyes*, 3 for the true *Gout*, 20 for the *Gravel*, 17 for *chronic Head-achs*, 30 for *Spitting of Blood*, 10 *Hypochondriac*, 15 for the *Jaundice*, 25 for *Incontinency of Urine**, 3 for the *Lethargy*, 7 for the *Lientary*, 30 for the *Leprosy*, 20 for the *Lumbago*, 14 for *Madness*, 5 for *Melancholy*, 31 for the *Measles*, 20 for the *Palsy*, 29 for the true *Peripneumony*, 11 for the true *Pleurisy*, 73 for *cutaneous Diseases*, 7 for the *Sclatica*, 53 for the *Small-pox*, 5 for the *Strangury*, 15 for the *Scrofula*, 20 for *Scalped Heads*. There remain 680 patients, whose cases are not here mentioned, having been chiefly *Chirurgical*, *Venereal*, the *Itch*, or feigned complaints.

* This is often a complaint feigned by seamen, at other times it proceeds from falls or bruises.

P R E-

PRESCRIPTIONS

Adapted to most of the

DISEASES incident to SEAMEN.

Formulæ medicamentorum faciliū paratu, atque in morbis nauticis apprime utilium.

FEBRIS. *R* Sal. nitri unc. ii. cremor. tartari, unc. iii. *M.* terantur in pulverem. *Dos.* drach. *ss.* sextâ quaque horâ. *R.* Test. ostreorum præp. (seu cretæ alb. præp.) unc. ii. cremor tartari, unc. i. *M.* fiat pulvis. *Dos.* drach. *ss.* sextâ quaque horâ. *R* Sal. tartari, unc. i. Cremor. tartari. unc. iii. Sacchari albi drachm. iii. diligenter simul in pulverem terantur. *Dos* drach. *ss.* sæpius in die. *R* Aquæ hordeatæ, lib. ii. cui adde pro re nata sal. nitri drach. i.—vel oxymel. simp. unc. i *ss.*—vel gum. arabici unc. *ss.*—vel elixir vitrioli acid. drach. i.—vel spir. vitrioli fort. scrup. *ss.* Sit pro potu usitato. *R* Aquæ hordeatæ lib. ii. Cremor. tartari drach. i. coque usque ad solutionem tartari, et decocto subsidentiâ depurato adde syr. e succ. limonum unc. i. Sit pro potu assiduo. *R* Aquæ puræ lib. vii. spiritus vini tenuioris lib. i. sacchari albi unc. iv. *M.* fiat julepum commune. *R* Julepi commun.

mun. unc. vi. cui adde pro re nata tartari
 emetic. a gr. i. ad gr. iii. — vel vini antimon.
 a drach. i. ad drach. iii. — vel spirit. nitri dul-
 cis drach. ii. — vel spirit. vitrioli dulcis drach.
 i. — vel vini crocei unc. fs. — vel sal. nitri
 scrup. ii. vel sal. diuretici drach. i. — vel mos-
 chi (cum saccharo triti) a scrup. i. ad scrup.
 ii. — vel sal. cornu cervi (omisso spir. vinos.
 ten.) scrup. i. Dos. unc. i. quartâ vel sextâ
 quaque horâ. R. Camphoræ drach. i. mu-
 cilag. gum. arabici drach. v. probe subigan-
 tur. Dos. gr. xxv. quartâ vel sextâ quâque
 horâ. R. Rob. limonum sal. tartari (vel
 absinthii) aa drach. i. aquæ puræ unc. iv.
 tinct. cinnamoni drach. vi. syrup. simp. unc.
 fs. M. et adde pro re nata Mithridatii a
 drach. fs. ad drach. i. fs. — vel elect. e scordio
 drach i fs. aut drach. ii. — vel spirit. laven-
 dulæ comp. drac. ii. — vel elixir. paregoric.
 drach. i. fs. Dos ab unc. i. ad unc. i. fs.
 R. Cortic Peruviani triti unc. i. vel unc. i.
 fs. aquæ lib. iv. coquantur ad lib. i. fs.
 inciendo paulo ante finem cocturæ gum. ara-
 bici drach. i. Colaturæ adde pro re nata
 tinct. cort. Peruviani simpl. lib. fs. — vel sal.
 nitri drach. i. — vel elixir. vitriol. acid. drach.
 i. fs. — vel vini crocei aut tincturæ Thebaicæ
 q. fs. Dos. ab unc. ii. iii. ter quaterve die.

Febris intermittens. R. Cort Peruviani
 pulv. unc. i. syr. e cort. aurantiorum, q. fs.
 M. f.

M. f. electarium. Adde pro re nata pulv. rhabarbari scrup. ii.—vel pulv. cort. cascarillæ unc. ss. vel pulv. nucis moschatæ, aluminis rupei āā drach. ii.—vel sal. ammoniaci pur. drach. i.—vel rubig. chalybis præp. drach. ii. *R. Herb. absinthii Roman.* drach. iii. cort. aurantiorum siccāt. drach. i. aquæ puræ unc. xviii. coque parum ad lib. i. Colaturæ adde pro re nata sal. tartari (vel sal. absinthii) scrup. iv.—vel tinēt. cort. Peruviani simp. unc. iv.—vel sal. ammoniaci pur. scrup. ii. Dos. unc. iv. ter die.

Scorbutus. *R. Rob. limonum* drach. iii. sacchari unc. ii. optimè commistis adde vini albi Hispan. lib. i. Dos. ab unc. ss. ad unc. ii. quartā quāque horā, quo tempore agitetur lagena ut lenis excitetur fermentatio. Fit quoque in vicem rob. substituendo suc. limonum unc. v.—vel suc. aurantiorum unc. vi. *R. Summit. pini Anglicè dictæ hemlock pine Gallicè la Prusse, sive epinette blanche,* lib. i, optimè contusis in mortario affunde aq. tepid. lib. viii. macera in vase clauso, subinde agitans, per 12 horas in loco tepido, et cola. Dos. lib. ss. mane et hora decubitūs, vel ad lib. ii. per diem. *R. Conserv. absinthii maritim. elect. lenitivi* āā p. æ. elixir. vitriol. acid. q. s. ad acerrimum saporem. Dos. drach. i. bis die. *R. Summit. absinthii maritim. manipul. i. cerevisiæ tenuis* cong. i. macera

macera per biduum pro potu assiduo. R Pulv. subt. cort. Peruviani drach. ss. syr. e succo limonum. q. s. f. bolus bis per diem sumendus.

Phthisis. R *Spermat. ceti* (cum mucilag. gum. arabici subact.) drach. iii. aquæ puræ unc. vii. tinct. cinnamomi syrupi simp. āā unc. i. M. Adde pro re nata sal. nitri drach. i. —vel lac. ammoniaci unc. ii. —vel syr. scillitici unc. ss. —vel elixir. paregoric. unc. ss. —vel sal. cornu cervi drach. ss. Dos. unc. i. sexta quaque hora. R *Furfuris* manipul. i. aquæ puræ lib. iv. coquantur ad lib. ii. colaturæ adde mellis despumat. unc. i. M. pro potu assiduo. R *Olei olivarum* syr. balsamic. āā unc. i. mucilag. gum Arabici unc. ss. M. f. lohoch, additis non nunquam spir. vitrioli tenuis gutt. xii. Detur cochleare parvulum subinde, vexante tussi. R *Infusi amar. simp. lib. ss. tinct. cort. Peruviani simp. drach. vi. elixir. vitrioli drach. ss. M. Dos. unc. ii. ter in die.* R *Calomel. gr. v. pulv. rhabbarbi scrup. ss. confect. cardiac. q. s. f. bolus matutinus.* R *Aq. puræ unc. i. ss. tinct. cardamomi syr. e meconio āā drach. ii. tinct. thebaicæ a gutt. xx. ad xxx. lixiv. Tartari drach. ss. M. f. haustus vespertinus.*

Rheumatismus Chronicus. R *Saponis Hispan. unc. iii. mellis unc. ii. M. f. electarium.* Adde pro re nata cinnabar. antimonii unc.

unc. i. fs.—vel flor. sulphuris unc. i.—vel gum. guaiaci unc. i.—vel gum. ammoniaci drach. vi.—vel ol. essential. e baccis juniperi drach. iii.—vel pulv. scillæ exsiccat. drach. i. fs. syr. e corticib. aurantior. (interdum e meconio) q. s. f. elect. Dos. scrup. ii. bis in die. Medicamenta Varia. Tinct. guaiacina volatilis; a gutt. xx. ad drach. ii. ol. terabinthinæ æther. ad gutt. lx. bis die. Sal prunellæ, ad drach. fs. bis die. Bals. guaiacinum ad gutt. xxx. bis die. Vin. antimoniale, a gutt. xii. ad drach. i. fs. tartarum emeticum ad gran. fs. ter in die. Antimonium præp. ad drach. fs. bis die. Ol. essential. e seminib. anisi, ad gutt. xl. aq. calcis simp. ad lib. i. per diem. Aqua picea, ad unc. iv. ter in die. Sem. sinapi integra, ad cochleare unum sive unc. fs. bis de die. Psynchrolusia, seu immersio in aqua marina.

Diarrhœa—Dysenteria. Pulv. ipecacuanhæ, a gr. v. ad scrup. i.—Rad. rhabarbari, a gr. x. ad drach. i.—Vitr. antimonii cerat. gr. v.—Calomel, gr. v.—Pilulæ saponaceæ, a gr. v. ad scrup. fs. R Elect. e scordio drach. fs. f. bolus addantur pro re nata pulv. rhabarbari drach. fs.—vel rhabarb. torrefact. gr. xv.—vel pulv. ipecac. gr. i. M. R Spec. e. scordio sine opio scrup. fs. Philon. Lond. gr. vii. syr. e meconio, q. s. f. Bolus post singulas sedes repetendus. R Ca-

N

pit.

pit. papaver. alb. contus. unc. ss. cort. Peruviani trit. unc. i. ss. aquæ puræ lib. iv. coque ad lib. ii. sub finem injiciendo gum. arabici cinnamomi aa drach. i. colaturæ fortiter expressæ detur unc. i. omni bihorio, additis si res postulat elixir. paregor. guttis aliquot. R Aq. hordeat. unc. vi. vel. iv. mucilag. gum arabici unc. ss. vel drac. ii. M. f. enema. Adde pro re nata tinct. thebaic. gutt. xl.—vel elect. e scordio drach. ii.—vel vini rubri unc. ii.—vel decoct. Peruvian. modo præscript. unc. ii. R Cort. quercus drach. vi. coq. ex aq. pur. lib. iii. ad lib. ii. injiciendo sub finem coctionis flor. rosarum rubr. drach. ii. colaturæ adde tinct. cinnamomi unc. ii. tinct. Japonicæ unc. i. detur lib. i. per diem. R Aq. calcis simp. lib. i. syr. balsamic. (vel e meconio) unc. i. M. Dos. unc. ii. aut iii. ter die.

Colica Pictonum, Anglicè dry belly-ach. R Pulv. ipecacuanhæ gr. xii. tartari emetic. gr. i. M. f. pulvis emeticus si opus sit, interdum exhibendus. R Rob. limonum, sal. absinthii aa scrup. i. aq. menthæ spirit. unc. i. ss. opii puri gr. i. vel gr. i. ss. syr. e meconio drach. i. M. S. A. f. Haustus pro re nata sumendus. R Extracti cathartici gr. xv. vel drach. ss. calomel, gr. x. opii puri gr. i. ss. saponis alb. gr. vi. ol. essent. menthæ vulg. gutt. ii. syr. e. corticib. aurantior. q. s. Co-
6
gantur

A P P E N D I X. 179

gantur in massam pilularem S. A. in pilulas
gr. vi. dividendam pro dosi una. & Infusi
senæ commun. unc. iii. tinēt. senæ drach. iii.
olei olivarum opt. unc. ss. syr. e meconio
drach. ii. M. f. potio purgans. Detur unc.
i. quoque bihorio, post exhibitionem pilular.
modo præscript. utatur æger semicupio. & Ca-
pit. papaveris alb. drach. iii. aq. puræ lib. i.
ss. coq. ad unc. x. injiciendo sub finem coc-
turæ flor. chamæmeli drach. ii. Colaturæ for-
titer expressæ adde ol. olivarum unc. ii. sapo-
nis alb. unc. ss. M. f. enema. & Calomel.
gr. i. camphoræ g. vi. Bals. Peruviani q. s.
f. pilulæ duæ bis in die repetendæ.

A
DISSERTATION
ON
FEVERS and INFECTION.

THE SECOND EDITION Enlarged.

With new Observations on the JAIL DISTEMPÉR, and the
proper Methods of preventing and stopping its Infection.

N 3

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M.D.

ADVERTISEMENT.

THIS Dissertation formerly appeared under the name of *Two Papers on Fevers and Infection*, which were read before the Philosophical and Medical Society at *Edinburgh*, in 1761. When they were first laid before the public an additional chapter was given under the form of a *Postscript*; and to the present edition numerous observations are added on the *Jail Fever*, and the means of stopping the infection.

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184 ADVERTISEMENT.

fection. These large additions induced me to alter the original title, as the whole now tends to form one general system of practice in contagious diseases.

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DISSERTATION

ON

FEVERS and INFECTION.

CHAP. I.

Cases of Infection in 1758, 1759,
and 1760. General means of
purifying infected Places and
Substances.

Hasslar Hospital, near Portsmouth, 5 June, 1761.

SECT. I.

State of Infection in 1758, and 1759.

*State of Infection in the fleets at Spithead,
in the years 1758, and 1759.*

OF the various diseases which afflict
mankind, few are more fatal, none
more frequent, than the fever. A disserta-
tion on this disease, therefore, but more par-
ticularly on the means by which it is pro-
pagated, and conveyed from causes hidden,
and

186 *State of Infection in 1758 and 1759.*

and too frequently unsuspected, I propose as the subject of the following sheets.

A very extensive practice in fevers during three years, in one of the first hospitals in Europe, enables me in some measure to make researches into the dark and abstruse subject of *infection*. The reading of what has hitherto been published, has induced me to write my own sentiments upon it; and chiefly with an intention to select from a *Chaos* of contradictory precepts, the most simple, and effectual means of protecting particular persons, as well as guarding the community in general, from this contagion.

On my first coming to this hospital in June 1758. I observed, that the men in the large ships of the fleet were generally healthy, but that several of the smaller vessels were infected. The sick who were sent on shore, particularly from the *Saltafk Sloop*, *Richmond Frigate*, and *Infernal Bomb Vessel*, notwithstanding the small number of their *complement*, laboured under fevers of the most malignant kind.

The *Revenge* and *Montague* about this time arrived from the *Mediterranean*, the crew of the *Revenge* being in a very sickly condition. By smoking this ship well with tar, the infection had abated, about a month before her engagement, on the

State of Infection in 1758 and 1759. 187

28th of *February* with the *Orpheus*. But some seeds of the contagion remaining undestroyed, the crew were again attacked with fevers; and some of them conveyed the distemper into the *Foudroyant* and *Orpheus*, prizes taken from the *French*.

The people in the guardships at *Spithead* were healthy, till the latter end of *July*, or the beginning of *August*, when a large draught of men, arrived in tainted vessels from *Ireland*, and communicated an infection to those ships, by the cloaths, and other moveables received from their tenders.

Those on board the *Saltash* were seized with a fever, which seemed nearly to resemble that malignant jail distemper, of which *Sir John Pringle* * has given an account; and out of her small complement of 120 persons, above 80 were infected with a contagion, much more virulent and dangerous, than that in the guard-ships, or in any other vessel then at *Spithead*.

In the months of *July* and *August* 1758, when the ships which had lately arrived from the *Mediterranean*, together with some smaller vessels, were distressed with fevers; the scurvy prevailed in the grand

* Observations on the Diseases of the Army. Part iii. chap. 7.

188 *State of Infection in 1758 and 1759.*

fleet under the command of *Lord Anson*, and in the detachment from it under *Lord Howe*. It raged mostly in the larger ships. From those fleets upwards of 400 sick were sent to the hospital, the greater part of whom were highly scorbutic; none of them had fevers.

In the months of *September* and *October*, after the reduction of *Louisburg*, the *North American* ships arrived at *Spithead*; several of which were infected with a malignant fever. The scurvy was likewise super-added to this distress; and those of a scorbutic habit being seized with the fever, was a proof of its proceeding intirely from infection. For I have found, that the scurvy is a disease in its nature opposite to that of a fever; insomuch that even an infection is long resisted by a scorbutic habit.

It is remarkable, that since the commencement of the present war*, the greatest number of patients in this hospital, and those who were afflicted with fevers of the worst kind, came from *North America*. The fever brought from thence this year went commonly under the denomination of the *yellow fever*, from the sick often becoming yellow. In the

* Declared against France, Anno 1756.

months

State of Infection in 1758, and 1759. 189
months of *September, October, and November*, about 300 patients, with either this fever, or the scurvy, were received into this hospital from the *North American* fleet; and of these 28 died.

In the beginning of the year 1759, when the infected vessels were properly purified, and their men free from fevers, as was likewise the fleet at home; the *Conqueror* and *Edgar*, two new ships of the line, and afterwards the *Temple*, arrived at *Spithead*. They had been manned partly with pressed men from the *Princess Royal* at the *Nore*, and from *Jails*. By draughts from them an infection was communicated to the *Royal Anne* guardship, and to the *Resolution* then fitting out at *Portsmouth*.

The fever, which raged in all these ships, greatly affected the breast. Some who were seized with it (as if they had been under a salivation,) spit up six or eight pints of a thin *phlegm* in 48 hours; and to prevent suffocation, were obliged to have their heads supported by pillows. Their blood was extremely viscid and glutinous. This I observed, even during the last stage, in a person from whom it was then necessary to take blood for a pain in the breast, greatly impeding respiration. The head was affected often with a heaviness,

190 *State of Infection in 1758, and 1759.*

vinefs, and dull sense of pain, feldom with a *delirium*. Cough, fputting, and pricking pains of the breast, were the moft univerfal complaints. Some, to outward appearance, as alfo by their own account, were quite well; but their pulse was found to be quickened, their tongue foul, and when raifed from the pillow, they complained that their heads were giddy.

The attack of this *infection* began with fhiverings, fucceeded either by pain of the head or breast; feldom by an univerfal pain in the limbs, but moft frequently by a tightnefs of the breast, and cough; which laft raifed the acute pains in the cheft.—Several who recovered, were afterwards diftreffed with a dulnefs of hearing;—many relaps'd.——A midfhipman, after being able to fit up for fome days, fell again into the fever, which was accompanied with convulfions, and expired in 30 hours after the laft attack, when his body was found covered with *Petechiæ* *. A few died confumptive, being exhausted by the vaft difcharge in fputting. In four or five perfons there were fymptoms of malignity; and out of above a hundred patients received into the hofpital from thofe fhips, eight died of the fever. This

* This term, as here ufed, is explained in chap. ii. feft. 3.

dis-

State of Infection in 1758, and 1759. 191
distemper, if it had occurred elsewhere than in the ships, might perhaps have been judged solely inflammatory, and to have proceeded from causes very different from the real one.

The *Edgar* sailed soon after for the *Mediterranean*, where the contagion in a few months acquiring great vigour, together with a superadded scurvy, destroyed sixty of her men. The manner in which the infection was removed from the ship, though not unusual, is worth relating. In the engagement, which happened that year with the *French* fleet, on the coast of *Portugal*, twenty-five barrels of gun-powder were fired on board of her during the action; and to the surprize of the officers, none of her men were afterwards attacked with fevers.

But to return to what passed in the fleet at *Spithead*. In the same year, towards the latter end of *April*, the *Melampe* arrived there, having a distemper amongst the men, of which the surgeon gave the following account.—Upon receiving two persons from the *Princess Royal*, a guardship, many of the crew were seized with fevers, which appeared to be of the intermittent kind; and, having administered to them the bark in large quantities, he did not lose one patient.

On

192 *State of Infection in 1758, and 1759.*

On *April* the 27th, twenty persons in fevers were received from this ship, and more sick were daily sent, in all to the number of 42.

They had been suddenly seized in a state of perfect health, with a severe trembling, upon which ensued pains in the head; and often (to make use of their own expression) *in all their bones*. Some had, two or three times in twenty-four hours, a return of the shivering, which resembled the fit of an ague. A few were attacked with it once every day; others every other day, in the form of a regular *tertian*. With many this cold fit continued for five or six hours; the partial sweats which succeeded it were of no benefit; and even a more profuse evacuation in that way gave but small relief. The pulse commonly beat quick, and was low.—Most of these patients had been bled on board their ship; but none of them after they came on shore to this hospital, as their breast was altogether unaffected, and their fever much lower than that which formerly afflicted the people belonging to the *Conqueror*, and the other ships already mentioned.

We observed the natural *crisis* of this infection to be sometimes by stool; and when a purging came on, the patient was immediately restored to health. But the
reco-

State of Infection in 1758, and 1759. 193

recovery of the greatest part of them was owing to *Blisters*, and the effect of these was both surprising and sudden. I have more than once in an evening ordered eight or ten to be blistered, and have left them with a quick pulse, great heat, immoderate thirst, a pain, confusion and heaviness of the head; and what to a physician, conversant with such fevers, communicates a most certain knowledge of the condition of the patient, such a lifeless sunk state of the eyes as denoted great danger *. But next morning I found these patients with a lively brisk eye, a calm pulse, and with a desire to get out of bed. Of those 42 infected men, though many relapsed, yet not one died.

The *Portmahon* was the next ship that brought an infection to *Spithead*, among a draught of prest men from *Scotland*. The contagion was quickly conveyed by them into the *Royal Anne* guardship, notwith-

* When visiting a ward, containing 20 patients in fevers, at *Hasslar* hospital, where no curtains are hung about the beds, one may at first view discover the most dangerous cases.

There is somewhat to be observed in the eyes, and their motions, which cannot be described, and yet indicates the present condition of the patient, (if he is not at that time just roused from sleep) better perhaps than any one other symptom, singly taken into consideration.

194 *State of Infection in 1758 and 1759.*

standing all such as appeared sickly were sent to the hospitals.

In *October* we received 24 of these patients, the rest being sent to the *Hospital-Ship*. One of them died of the fever, another of a flux, and a third of a consumption after his illness. Several were afflicted with a severe cough, on which account they were frequently bled, and their blood abounded with *Gluten*. In the beginning of this fever, a profuse bleeding from the nose was usual, and greatly relieved the head, which was always affected.

By the use of blisters the fever abated, on the second, third, fourth, or any other day of the fever, reckoning from its first attack. In four patients, with whom the blisters proved ineffectual, the head-ach and *delirium* were in a few hours removed by *antimonial* medicines. Relapses were, as in similar infections, frequent. *Petechiae* appeared on some of those men, who were sent to the hospital-ship. This was judged, and with good reason, to be a fever of a bad and malignant kind; and, what was very shocking, a great many of the patients from the *Portmahon*, whom I visited, had never changed their cloaths from the time they were pressed in *June*, to the 22d of *October*, when they came

came to the hospital. The unshifted linen and rags, which they had lain in for above four months, were sufficient to have bred an infection.

During the month of *October* the Squadron arrived from the *West Indies*, after the reduction of *Guadalupe*, so over-run with the scurvy, that, when in the Channel, ten or a dozen persons usually died of it every day. Out of three hundred and fifty scorbutic patients, who were sent a-shore from those ships, there was not one who had a fever. This I mention for the sake of the following remark.

The surgeon of the *Panther* told me, that forty of her men had died of the scurvy in their passage home; and, during that time, there were usually ninety patients in the sick apartment. The place, appropriated for the sick, was in the *bay* of the ship, and had no pipe from the ventilator, nor any scuttles cut through its sides, for the admission of the fresh air. A number of patients, thus closely crowded together, rendered the place so disagreeable and suffocating, that the sick were in a manner stifled for want of air. The surgeon, when visiting, could scarcely breathe in it, or remain for any length of time, without being obliged to have recourse often to the fresh air upon deck, and some-

196 *State of Infection in 1758, and 1759.*

times to the spirit of *hartshorn*, or to a glass of wine, for his immediate relief. He observed, that both the virulence and mortality of the scurvy were heightened by the unventilated air of the place, in which the sick for several weeks had been confined; yet out of above an hundred patients sent to the hospital by this surgeon, not one was remarked to have any symptom of contagion generated in that apartment.

The first ship, which arrived towards the latter end of this year from the fleet in *North America* was the *Loestoffe*. On the 18th of *October* fourteen of her men were sent to the hospital, and thirteen more on the 21st of the same month. The scurvy, the flux, and fevers, were reported to be the prevailing diseases in that ship.

The account given of the fever was to this effect. The company of the *Loestoffe* were in perfect health during the eight months they were in *America*, and until a few days before their departure from *Quebec*. At that time six recovered marines came on board from *Point Levi* hospital, and in forty-eight hours afterwards, among her company of two hundred people, fifty were seized with fevers and fluxes. In some, the sickness began with a flux, in others with a fever, but the
flux

flux was generally moderate and gentle. The fever continued commonly from five to ten days; two patients were distressed with it for a whole month. When the first attack was from the fever, a supervening flux proved salutary; but where the contagion made its first appearance with a flux, the accession of the fever carried off the patient. This ship was twenty-seven days in her passage to *England* from *Quebec*, and during that time six of her men died.

A *Spaniard*, one of the *Loestoffe's* crew, having relapsed, turned yellow on the sixth day of the fever. His chief complaint at this time was an universal uneasiness over his whole body, his head alone being unaffected. He earnestly intreated to be bled; though his pulse was low, I consented to his repeated solicitations, and permitted a small quantity to be taken from his arm. I had now the first opportunity of inspecting the condition of the blood in the yellow state of this fever. The *mass* was exceedingly *viscid* and *fizy*; and, after standing some time, the *grumous* concretion became covered with a yellow *gluten* half an inch in thickness, impenetrable to the finger, unless cut by the nail; the *serum* being at the same time of the consistence of a thin syrup, and of a

198 *State of Infection in 1758, and 1759.*

deep yellow tinge. A person, prompted by curiosity, tasted this *serum*, and found it bitter. Another, not knowing it to be the *serum* of blood, judged it to be a composition of foot.

This fever was plainly the same with that which was brought last year from *North America*, and commonly by us denominated the *yellow fever*. It was oftener accompanied with a flux, than the fever of the preceding year; and of the sick sent to this hospital a greater proportion died from this ship, than from any other; for of thirty-four which were admitted, some with the flux, and others with the scurvy, but the greatest number with fevers, we lost nine patients.

In *November*, after the important conquest of *Quebec*, the *North American* fleet returned to *England* with several of the ships companies in perfect health; while the crews of others were afflicted with an active and powerful contagion.

In the number of the healthy ships were the *Prince Frederick* and *Captain*; also the *Somerset* and *Stirling-Castle*, which arrived after the others. The infected were the *Princess Amelia*, the *Orford*, *Shrewsbury*, *Medway*, *Dublin*, and *Neptune*. The most vigorous contagion was in the two last. The *Dublin* had buried in the passage home

State of Infection in 1758 and 1759. 199

nineteen men ; and, on its arrival at *Spithead*, they reported to the hospital ninety sick in fevers, fluxes, and the scurvy. On board the *Neptune* the mortality had been much greater, having lost, it was said, one hundred and sixty of her men in a few months, and on her arrival the *sick List* contained one hundred and thirty-three sick. The surgeon had been seized with the yellow fever, but was recovered. One of his *mates* had the fifth relapse into it, when at *Spithead*.

Some attributed their sickness to the *French* prisoners, whom they had received on board. Others to the *New England* volunteers, who were very sickly ; and the fever was introduced into several ships by the marines from *Point Levi* hospital. Of near four hundred patients, who were attacked during the months of *November* and *December*, with the contagion in those ships, and were brought into this hospital, twenty-six only might be said properly to have been destroyed by it. And of that number one third were nearly past all hopes of recovery before they were landed.

S E C T. II.

Fevers produced by infection.

*Observations on the yellow and spotted fever;
remarkable instances of infection.*

IT may be now proper to give a few observations on this infection, as they were written at different times in the wards of the hospital.

“ 20th November. The *crisis* of this
 “ fever happens at no fixed period, nor
 “ on any certain day, that can be foretold.
 “ The sick recover chiefly by the discharge
 “ from blisters *. A few had spots; on
 “ some they were *petechial*, most of whom
 “ are well; as also many who, in the
 “ course of the disease, became yellow.
 “ This yellowness is at present much more
 “ frequent than the spots. The tincture
 “ over the skin is universal, of a deep
 “ yellow tinge, often painful, and dis-

* Several foreigners, especially the *Spanish* physicians, have entertained an unreasonable prejudice against blisters, on account of the severe *strangury* sometimes occasioned by their application. But that it is for the most part quickly abated, by throwing up a spoonful or two of linseed oil in a *clyster*; or by taking a few grains of *camphire* and *nitre*, drinking plentifully of cooling and mucilaginous liquors; or even by anointing the *os pubis* with a liniment prepared with *camphire*.

“ agree-

“ agreeable to the sight. One *Ashley* has
“ relapsed three times, and in each re-
“ lapse there appeared this jaundice. In
“ some, the stools, urine, and discharges
“ from the blisters, are of a yellow hue;
“ but this is not observed in all. Vomit-
“ ing an unusual symptom.

“ 1st *December*. Few in this fever *co-*
“ *matose*. In bad cases a slight *delirium* at
“ intervals usual. The pulse always quick,
“ seldom full or strong. The tongue, for
“ the most part, foul. The urine vary-
“ ing, but often yellowish.—The blood
“ taken from a marine, resembles that of
“ the *Spaniard* before-mentioned, is viscid
“ and glutinous; both the *gluten* and the
“ *serum* being yellow, as is the colour of
“ the patient.—It having been remarked,
“ that blisters have produced not only the
“ most salutary effect in removing the fe-
“ ver, but that such as recovered, with-
“ out their having been applied, were
“ subject afterwards to a giddiness, and
“ pain in the head; it has lately become
“ a general practice to blister all who have
“ the least symptom of this infection, and
“ those complaints are no more heard of.
“ The discharge from the blisters seems
“ likewise to assist in preventing a relapse.

“ 10th *December*. The early application
“ of a blister causes often a sudden abate-

“ ment

“ ment of the head-ach and fever. In
 “ the more advanced stages of the disease,
 “ blisters produce no bad effects ; on the
 “ contrary, they often give the greatest
 “ relief, though not so immediately as in
 “ the first stage. During the course of
 “ the fever, some have a tendency to loose
 “ stools, others to a severe purging * ;

* In this complicated state of the fever, with a flux, an ounce and half of a strong decoction of *bark* and *snake-root* was given every four hours, with the addition of five drops of the *Thebaic* tincture. I have also given in the same circumstances, *antimonial* medicines in small doses, with a view to abate the fever ; but so combined with *opiates*, as to prevent their ruffling the stomach and intestines. Upon the decline of this fever, the danger from the flux became less ; and I have, with pleasure, observed both methods sometimes successful in removing the fever and flux at once. The former practice hath already been recommended by my good friend Dr. *Whytt*, (see *Observations on the Diseases of the Army*, by Sir *John Pringle*, edit. 3. p. 245.) and I am informed, that in the autumnal fluxes of hot countries, the like method of treatment, after proper evacuations, has also been found successful. Such fluxes as continued obstinate, after the recess of the fever, we generally stopped by small doses of *Ipecacuanha*.

Here it may not be improper to remark for the benefit of young practitioners, that in many fevers, where the complaint or pain is fixed and permanent, *topical* applications will oftentimes afford more immediate relief, than medicines taken into the stomach, or applied at a distance from the part affected ; in like manner as a vomiting and *hicough*, that have resisted the effects of opium, musk, and other powerful medicines, taken into the stomach, are often instantly stopped by a warm, spi-

“ but

“ but, after the application of a blister.
 “ these complaints frequently become at
 “ least milder. The state of the belly is
 “ carefully attended to, as a lax state of
 “ it is judged the most eligible in all in-
 “ fectious disorders. Internal medicines
 “ have been duly administered, more par-
 “ ticularly *Camphire* * with vinegar whey,

rituous, or *camphorated* application outwardly to the stomach. Thus *opium* in clysters will sometimes afford more immediate relief in fluxes, and other disorders of the intestines, than when administered in any other manner; and in the same form, I have often given *spiritus æthereus*, wine, bark, &c.

Cupping and *blistering* should be used upon the trunk of the body and limbs, on, or as near as possible to, the parts affected with a fixed pain; as also, in many cases, blood should be taken from the vessels nearest to the seat of the complaint.

* In this hospital, as soon as a patient in a fever was admitted, and put to bed, when there was no immediate indication for making evacuations, it was our general practice, to give him four or five grains of *Camphire* every four hours, washed down with a draught of vinegar whey. The *Camphire*, being dissolved in mucilage of gum *Arabic*, generally sat easy upon the stomach; and I esteem it a proper medicine in such cases. Another medicine much used, together with camphire, especially in fevers of a bad kind, was the following:

R *Rad. serpentar. virg. contus. dr. vi. aceti lib. ij. coque ut sit una libra colaturæ, cui adde ag. alexiter spir. syr. e corticib. aurantior, ana unc. ij.* Of this the patient took two spoonfuls every four hours. It was, however, seldom prescribed by itself, but generally with an addition (to the above proportion) of *sal cornu cervi dr. iij. vel spiritus ejusdem unc. i ss.* and sometimes the acid of the

“ often

204 *Fevers produced by Infection.*

“ often the bark, wine, &c. and, in the
 “ yellow state, the *neutral saline draughts*,
 “ either with *thebaic tincture*, or *rhubarb*,
 “ according to the state of the body. But
 “ we esteem many of those internal me-
 “ dicines, as also bleeding, which I have
 “ seldom prescribed, as only temporary,
 “ or but auxiliary means of relief, in re-
 “ spect to blisters. An emetic, given on
 “ the first appearance of a relapse, often
 “ produces the happy effect of preventing
 “ a return of the distemper.

“ *December 12.* Although the weather
 “ be extremely cold with an intense hard
 “ frost, which has continued many days;
 “ yet from the *Neptune, Princess Amelia*,
 “ and other infected ships, they continue
 “ daily to send patients in this fever;
 “ some of them besprinkled with nu-
 “ merous *petechiæ*. Thus, the severity of

vinegar was almost neutralised with crabs eyes or chalk.

Having frequently observed the attack of an intermit-
 tent fever, to be prevented, on its approach, by a draught
 of *Vegetable Acid* and *Alkali*, (such as *Vinegar* and powder
 of *Crabs Eyes*) taken in a state of fermentation, I am apt
 to think, there is much greater febrifuge virtue in such
 draughts, exhibited when in a fermenting state, than in
 a state of perfect quiet and saturation.

To a pound of this decoction of snake-root were added
 occasionally, *tinct. cort. Peruv. simp. unc. iv. vel pulv. subt.*
cort. Peruv. unc. ss. vel vin. croc. unc. i ss. And on some
 occasions *elix. paregor. unc. j.*

“ the

“ the season does not stop, nor even check,
“ the contagion in those ships.”

December the 14th, when visiting in a fever-ward, I was surprised to find three patients, from the *Cambridge*, whose company I supposed to be healthy. According to my usual method, I began with asking them concerning the state of their ship, in point of health; and what they might imagine to have been the original cause of their own illness. Their answer implied,—that six hundred and fifty men, who composed the *complement* of the *Cambridge*, had enjoyed a good state of health for a long time past; until they, with some of their shipmates, were ordered on board the *Neptune*, to prepare that ship for the dock, which was then in great distress for want of men, most of her people being at the hospital.

Of those three men belonging to the *Cambridge*, one, on the fifth day of the fever, became spotted, and died; another narrowly escaped with life; and I have reason to believe, that their other shipmates, who were employed in the *Neptune*, conveyed the distemper to the *Cambridge*, as she soon after sent to the hospital several afflicted with the same fever.

I would have it here observed,—That when those men from the *Cambridge*, (one
of

of the most healthy ships then in the fleet) became infected, their infection did not proceed from any person being sick in the *Neptune*. For upon the first complaint, or the appearance of any man being there taken ill, he was immediately sent to the hospital. And the same is to be observed, with respect to the numerous infected patients, who were daily sent for five or six weeks, from the *North American* ships; that is, from the time of their arrival at *Spithead*, till their purification in the dock. During this period, no sick man was kept for an hour on board any of them, if the weather permitted to send him on shore.

Thus, though the sick with the fever were removed into the hospitals, yet still the pernicious source of infection continued to be as active as ever in the ships.

It was also at this time very remarkable, that no seamen, but those who had been on board the *North American* ships, were seized in this hospital with that fever; notwithstanding the utmost precaution did not prevent their too frequent communication.

Besides, in those ships where there were no sick people on board, it was plain the infection could not proceed from a foul air, or want of attention in washing and keeping them clean. They were furnished
with

with ventilators; and I have it from good authority, that the *Neptune* and *Dublin*, where the men were most sickly, were kept uncommonly clean and neat. The former being a second rate, a prodigious draught of air must have been admitted from her having three tier of ports; and when those ports were open, (which was all the time she lay at *Spithead*, and in *Portsmouth Harbour*, while the contagion was so violent) the ventilation and renewal of the air exceeded what could be effected in most other places, in an hospital, or in any chamber, by open doors and windows. The diet of the people was, at that time, fresh beef and broth, with greens.

I enquired particularly into the condition of the sick-apartment in the *Neptune*, while she was at sea; and found it was on the lower gun-deck, and was both spacious and neat. In it were cut two scuttles for the admission of fresh air, and these were at all times kept open. The adjoining ports were also thrown up, when it could safely be done, though the fresh air, admitted by the two scuttles, was sufficient to keep the place at all times sweet, and free from any bad smell. It was washed twice a week with warm vinegar, besides being duly cleaned out every day.

Sir

208 *Fevers produced by Infection.*

Sir Charles Saunders, who commanded the fleet, was on board this ship, and spared no method to have the apartment for the sick, the whole ship, together with the men, kept wholesome and clean.

The practice of cleanliness, and the benefit of the freshest air, did not however avail to remove this contagion; which continued till the ship was taken into dock, and properly purified by *Fire* and *Smoke*. After this operation, the ship and crew became perfectly healthy. This was the case likewise with all the infected *North American* ships.

Towards the latter end of *December*, the *Diana Frigate* arrived from *North America*. When she left that part of the world, the company was in health; but, a few weeks before she reached the coast of *England*, meeting with very bad weather, the men were attacked with fevers; of which the *Boatswain*, surgeon's mate, and some others, died. The report of this ship, at her arrival, contained thirty-two sick of a fever, said to be malignant, with a small degree of infection. One man expired soon after being landed. All the rest recovered their health in the hospital.

Thus a seasoned sound crew became infected, as it would appear, from the closeness

ness or damp below, occasioned by the *Hatchway* being kept shut.

Another instance of the like kind occurred in the *Saint George*, which sailed from *Spithead* about *February* 1760, with a healthy company; and returned, after meeting with rough tempestuous weather, in a sickly condition. The sickness, in both these ships, made its first appearance during an intense cold season, and was of a malignant nature.

On board most other ships of war, we were able to trace out the importation of the contagion, either from the *Princess Royal*, or the other guardships; from jails, unseasoned landmen; contaminated persons, or ships. The effects of it were discovered, for the most part, in a few days, and the importers of it sufficiently known.

S E C T. III.

State of Infection in the year 1760.

State of infection at Spithead in the year 1760. Instances of persons labouring under infectious diseases on board of ship without communicating the infection. Remarkable long state of health enjoyed by the grand fleet, under Sir Edward Hawke, on the coast of France.

IN the beginning of the year 1760, several frigates, viz. the *Postilion*, *Liverpool*, *Repulse*, and *Niger*, brought an infection to *Spithead*, which they received from some draughts of newly impressed men.

This infection was very slight. In many, its presence was known only by regular or irregular shiverings; which were often mistaken for a sudden chill or cold, and at other times for an ague. Several were subject to a return, at intervals, of those cold fits, even for three weeks after they came ashore.

In order to the separation of these tainted persons from the other patients in the house, which at that time was pretty full, some new wards, not before inhabited, were

were necessarily then opened. About twenty or twenty-five of those who appeared to be the most healthy, and on that account received into the new apartments, were seized with fluxes. In such as died of this distemper, I found large collections of *Pus* in the cavity of the *Abdomen*; as also ulcerations along the external surface of the intestines, without any apparent sign of a mortification in the parts. Their ship-mates, in the seasoned wards, were seldom afflicted with the flux. Their complaints were an universal disorder, pains in the limbs, sometimes in the head; a cough and spitting, with recurring shiverings. Two of them in the fever became yellow, and both recovered. But in a seasoned ward, containing twenty patients, it was uncommon to see more than two or three of them confined to their bed, as this infection was far from being virulent, and produced but in few instances a fixed fever.

However, from another quarter, we soon after received some infected patients. The *Garland*, a ship of twenty guns, arrived from *Plymouth*. Her men had been in perfect health, till some of them were sent to assist the *Shrewsbury*, whose crew was then mostly sick at *Plymouth* in the hospitals. On their return, they brought

212 *State of Infection in the Year 1760.*

along with them a spotted fever, which they communicated to their own company.

The patients received from this ship laboured under a fever of a more malignant nature, than any fever I ever had occasion to observe at *Haslar*; and their sickness appeared to be the consequence of a more violent contagion; so that it became necessary, without delay, to smoke and purify the whole ship. On the two following days after the operation, they sent ashore four sick; and from that time this pestilential contagion was entirely removed from the *Garland*.

In this hospital none of her people relapsed into the fever, which I ascribed to most of them being seized with the scurvy *, while on recovery from the fever; as at that time, an unusual, epidemic, and real scurvy, prevailed over the county of *Southampton*.

I have now given a faithful account of all such infectious fevers, as occurred in *Haslar Hospital* from *June 1758*, to the beginning of the year 1760. Most of these particulars are known to the gentlemen who attended my visits, many of

* See a particular account of this in my *Treatise on the Scurvy*, edit. 3. p. 271.

whom

whom are now alive; as likewise to the officers and surgeons of the respective ships.

Sometimes only one man in a ship may be seized with the *petechial*, or with the *yellow fever*, while all the rest continue unaffected.

Of this the *Magnanime* afforded an instance. She was seventeen weeks at sea, and for a whole month of that time, during very bad and stormy weather, had on board the men wounded in the general engagement on the 20th of *November*. Notwithstanding this long continuance at sea, and the violent storms that she encountered, yet of 700 men, five only were reported to us to be sick, besides the wounded; and these chiefly in *chronic disorders*. However, upon their landing, I found that one of them laboured under a spotted fever, of which he soon died, overspread with *petechiæ*. Another person was sent from the *Raven sloop* in the *yellow fever*, of which he also died; and yet no other person on board of those two ships were either before or afterwards taken ill of such fevers.

I do not recollect many such incidents, that have occurred in the hospital, although I have frequently visited patients in fevers, similar to the above-mentioned, in fami-

214 *State of Infection in the Year 1760.*

lies where an infection was not in the least suspected.

But let us leave this part of the subject for the present; and, turning our eyes to a more pleasing scene, take a view of the general state of the fleet, in point of health, during the course of the years 1759 and 1760.

In the grand fleet of *England*, commanded by Sir *Edward Hawke*, who, on the 20th of *November*, defeated the *French* under *Mons. Conflans*, they enjoyed a most perfect and unparalleled state of health. This fleet is supposed, at most times, to have consisted of above twenty ships of the line, and ten or more frigates, in which were embarked about fourteen thousand men. On the day of action, many of those ships and men had been above six months from *Spithead*; notwithstanding which, there was not then among them twenty sick in all. Out of eight hundred and eighty men in the *Royal George*, (Sir *Edward Hawke's* ship) there was but one man who was incapable of duty. In the *Union* (Sir *Charles Hardy's* ship) of seven hundred and seventy, they had likewise but one unfit for service; and on board the *Mars*, commanded by commodore *Young*, though a new ship of
sixty-

fixty-four guns, there was not a sick person.

It was hardly ever known before, that ships could cruise in the *Bay of Biscay*, much above three or four months at a time, without having their men afflicted with the scurvy. An exemption from which was entirely owing to this fleet having been well supplied with fresh meat and greens.

It is an observation, I think, worthy of record,—That *fourteen thousand* persons, pent up in ships, should continue, for six or seven months, to enjoy a better state of health upon the watery element, than it can well be imagined so great a number of people would enjoy, on the most healthful spot of ground in the world.

How long the health of these men might have been preserved, if their supply of the land productions had not been cut off, we cannot say. For, after this engagement, the victualling transports having been detained by contrary winds, they suffered much for want of provisions and water; and the commanding officers were at length reduced to circumstances, in this respect, little better than the common men. Notwithstanding which, it was more than six weeks after the commencement of those hardships, before the scurvy

made its appearance among them. And though most of the ships had been abroad, some seven, and others near eight months, yet they lost very few men, and those chiefly by the scurvy.

The *Royal George*, the capital ship in that fleet, sailed from *Spithead* the 17th of *May*, 1759, and did not return till the 18th of *January* following. When she left *England*, twenty of her men laboured under coughs, and other complaints, the usual consequences of the irregular behaviour of seamen when on shore. A boy having brought with him the small-pox on board, five of her people died of that disease; which were the only persons who died in this eight months cruise. Before her arrival at home, the crew in general became more or less afflicted with *scorbutic* symptoms. And, when they got into the port, twenty, afflicted with the scurvy, were sent to the hospitals; of whom only one man died, having had a dropsy some time before.

To the general state of good health enjoyed by the ship's companies in this great fleet, there were, however, two exceptions. These occurred in the *Sandwich* and *Tor-bay*. The former being a new ship, manned with people unaccustomed to the sea, and with many from the *London* jails, re-
turned

State of Infection in the Year 1760.

turned to *Spithead* towards the end of *December*, 1759, with a sickly crew, after a long and separate cruise from the rest of the fleet. And in the month of *June*, 1760, several patients, having a malignant fever, were sent from the *Torbay* to the hospitals at *Plymouth*.

But, exclusive of the companies of those two infected ships, I have reason to believe, that there were few or none of the men employed on the coast of *France*, and in the *Bay of Biscay* for eighteen months, (viz. from *May*, 1759, to *December* 1760) whose number may be computed at fourteen thousand at first, and ten thousand afterwards, kept constantly in those seas, commonly from seven to eight months at a time, who were afflicted with any disease but the scurvy; and with that only, when not supplied with fresh provisions.

We must except such *chronic* complaints as always occur among seamen; such as *rheumatic* pains, old hurts, and bruises, with consumptive cases, and the like; most of them being the consequence of former disorders, or of old age, and its infirmities.

SECT.

S E C T. IV.

Properties of infection.

Healthfulness of the sea-air. Difference in fevers arising from infection; the sick themselves less apt to communicate infection than their apparel: substances to which it most strongly adheres. Malignity of the fever proportionable to the virulence of the infection. Ventilation not always sufficient to remove infection.

HAVING given the state of infection in the fleet for upwards of two years, I now proceed to deduce its more general properties.

First. It appears, that the sea air is wholesome and salutary to people who have been for some time accustomed to breathe in it, and who are supplied with their proper food or nourishment.—And experience has further shewn, that persons at sea, are less subject to fevers than those at land.

Obstinate *agues*, and what is called the *bilious cholic* from being accompanied with vomitings and a purging of *supposed bile*, but especially the *flux*, are sometimes epidemic in the environs of *Portsmouth*, during the autumnal season, I have observed them

them raging among the inhabitants, strangers, and troops, with an uncommon degree of violence ; while, during this period of universal distress at land, ten thousand men in the ships at *Spithead*, remained perfectly free from them.

From these accumulated proofs, this position seems evident. Indeed, so pure and untainted is the atmosphere at sea, from being duly ventilated by refreshing winds, that it becomes the undoubted *asylum* for health in sickly climates, and during the rage of epidemical or pestilential diseases at land.

Add to this, that the effects of a contagious disease are more clearly discovered in fleets, or in a number of different ships, than in towns or villages, as all the ships, which compose a squadron, are under the same influence of diet and of climate, the circumstances of the men being likewise in other respects for the most part similar. Hence, an infection may often spread itself unsuspected over a town or village, while in a fleet of ships its influence becomes more apparent, from its confinement to one or more ships.

Secondly. It also appears,—That fevers of various denominations, and of very different kinds, may be occasioned by a contagion ;

tagion; and that an infection in a village, house, prison, or any other place, be it either imported, or originating there, does not always produce a malignant, much less a mortal fever.

To illustrate more fully the present point, let us apply to the fever what occurs in the flux.

Every one knows, that the *Camp-dysentery*, and indeed most *dysenteric* fevers, are generally both infectious and malignant. But I had a patient in a *chronic flux* of two years continuance, which seldom confined him to his bed, and yet he infected with it almost all persons who used the same privy. He had been at different times, in all fifteen months, in the hospital at *Hallifax*, for this complaint, and he afterwards remained three months at *Haslar*; from whence he was discharged as incurable. This person was lodged in a ward with *Rheumatic* patients, several of whom daily complained of a severe purging; which they imputed to their medicines. The nurses of the ward became affected in the like manner, who first discovered it to be owing to this patient's stools, which were slimy, and very offensive. And, upon debarring him from the use of the common privy, this general

neral complaint among them ceased. Cases of a like kind have frequently occurred in this hospital.

I think I have further observed, that the propensity of the patients to frequent relapses into a fever, is in a degree proportional to the contagious disposition of that fever; or, at least, that patients relapse more frequently into a fever received by infection, whether it be of a mild or virulent nature, than into other fevers. This circumstance may, perhaps, sometimes assist us in judging of the nature and cause of a distemper.

Thirdly. By a fixed attention to this subject for some years past, I am convinced, that the *body* of the diseased, kept exactly neat and clean, is not so liable to impress the *taint*, as his late wearing apparel, dirty linen, and uncleanness of any sort about him long retained in that impure state.—I say, these last contain a more certain, a more concentrated, and contagious poison, than the newly emitted *effluvia* or excretions from the sick.

What secretions do most readily convey the infection, and at what period of the disease, or under what circumstances the greatest danger may be apprehended, must be referred to a future discussion. I shall at present only relate, in confirmation of
what

what has already been advanced, the different cases of the labourers, and of the nurses at *Haslar*.

The duty of the labourers was to carry up the sick in their infected cloaths to the wards; and afterwards to bundle up, and bring away, every article of their apparel. These were repeatedly infected, and with the most obstinate fevers. Whereas the nurses, who undrest the patients (near a good fire, which was always kept in the wards), and who constantly attended them after they were put in a clean bed, and in clean linen, were not only, in many respects, less liable to the fever; but when they did receive an infection, it was generally much milder, and sooner removed. Several, indeed, of the nurses who suffered, owed much of it to their own indiscretion, by keeping the dirty linen, after it had been taken from the sick, for some days in the rooms where they slept, contrary to the rules of the house. One nurse was three times by that means infected. These observations may serve to enforce to the sick, and their attendants, the necessity of an exact neatness, and a constant cleanliness about both.

Fourthly. We are of opinion, That, besides the materials of wool, cotton, linen, and apparel of almost every sort, the seeds
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of an infection are strongly adhesive to many other substances in infected chambers, and other places. Beams of wood, as in ships, chairs, bedsteads, and other furniture, as also various utensils used about the sick, may, doubtless, become strongly tainted. This has been sufficiently evinced by the foregoing relation of the course of the infection in the fleet.

Fifthly. The degree and danger of the fever will in a great measure depend on the quality, or the specific nature of the source from whence it is derived. By the source of an infection I mean those seeds of contagion expressed by the Greek appellation *Μιασματα*, wherever imbibed, or to whatsoever materials they may adhere, or, what is sometimes understood among physicians by the Latin appellation *Fomes*. Sir John Pringle has given an account*, that of twenty-three persons, who were employed in refitting the old tents in which some sick had lain, seventeen died of the infection; so virulent must that source of poison have been: whereas, on the other hand, we have seen the condition of the *Melampe*, and of many other ships, where there were undoubted proofs of an

* Observations on the diseases of the army, p. 27.

infection; and yet the fever produced by it was very mild, and in few instances proved fatal.

To illustrate this position by other examples, we must observe, that during the months of *January, February, and March, Anno 1760*, twenty-four patients were received from the *Garland**; most of whom had *petechial* spots, accompanied with other malignant symptoms, and five of them died of the fever. During the same months, one hundred and five infected persons were sent from the *Postillion, Liverpool*, and some other frigates, of whom only eight died, and those mostly of a flux, proceeding from the damp in the wards, as before related.

Hence it seems altogether certain, that some ships are more strongly infected than others, or that they retain a more *concentrated* and poisonous *source* of contagion.

I cannot precisely say, that the number of the infected will be in proportion to the energy, or strength of this source; because I have known a greater proportional number infected from a very mild contagion, than were taken ill out of the small *complement* of the ship *Garland*, where the infection was of a very violent nature.

* See Chap. i. Sect. iii.

This

Thus much I am certain; that the danger of mortality will always be proportional to the strength of the infection.

Sixthly. Wherever this lurks, and in whatever materials it is harboured, the admission of the purest air, or the most perfect ventilation, will often not avail, either in removing or abating its activity.

This position might be proved, by many instances of a similar kind to what has already been mentioned, of the *Neptune*, *Dublin*, and other infected ships; which were kept remarkably clean, and well aired; but I shall confine myself only to one proof more.

When ships are to be put into the dock, it is usual to remove their men out of them into hulks in the harbour. These hulks are old ships, containing, as one would imagine, nothing but decayed timbers, capable of receiving or retaining infection. They may be compared to such old uninhabited houses as have the windows broken, or at least at all times kept open, and where the wind, cold, and rain, have the freest access. Not long since, a part of the company belonging to the *America*, having slept in one of those hulks, I remarked several of them were afterwards seized with fevers of a low and bad kind; while the other part of the crew who slept on board
Q their

226 *Means of removing Infection.*

their proper ship, were affected only with slight colds. I have indeed frequently met with instances of bad fevers, which have been got from those cold, raw hulks. It must also be remembered, that wholesome air, and even the severest frost, did not mitigate the force of the contagion in the *Neptune*.

S E C T. V.

Means of removing infection.

Means of removing infection. Infection destroyed by smoke. Means of purifying ships, when the men are removed, by burning tobacco, brimstone, arsenic. Means of purifying places, when the sick cannot be removed, by wood-fires, smoke of gunpowder, scent of burnt cascarilla, steams of camphorated vinegar, fresh air. Means of purifying infected cloaths, &c. their immediate exposition to the air improper, previous fumigation necessary. Caution in washing them.

UNDER some circumstances the source of an infection in a sick chamber, or in any other place, may be removed or destroyed by accidental means, for which we cannot account, and which we often cannot even ascertain. But it oftener happens

pens that it is very difficultly rooted out; that exact cleanliness with the benefit of a pure air, often prove insufficient to remove the evil. The sometimes unavailing efficacy of those means must not, however, occasion any relaxation of the attention to two articles so highly conducive, during every such calamity, to the preservation of the healthy; and to the recovery of the afflicted.

But if means so absolutely necessary to prevent a contagion, as cleanliness and a pure air, do often fail in removing or annihilating its secret source; it now gives me the highest satisfaction to affirm that I seldom or never knew a proper application of fire and smoke to be unsuccessful in producing the happy consequence of effectually purifying all tainted places, materials, and substances.

It is not to be doubted, but that, excepting the true plague, there has been an infection fully as pestilential, and as mortal, in some ships, as in any other place whatever; yet I never heard of any ship, which, after having been carefully and properly *smoked*, did not immediately become healthy. And if afterwards they turned sickly, it was easy to trace that sickness from other infected ships, jails, and the like places.

There are three methods commonly practised for purifying ships or vessels, after the men have been removed out of them.

The first is, by burning of *Tobacco*. A quantity of *Tobacco* is spread on several fires made with such old pieces of rope, as are called *junk*. These are dispersed into different places of the ship, and their heat and smoke afterwards closely confined below for a considerable time. By this operation, the *Neptune* and *Garland* were rendered perfectly healthy.

The second method is, by *Charcoal* fires, strewed with *Brimstone*. The heat and steam of those burning materials, for this purpose, must likewise be long and close shut up. Although this fume, properly applied, hath been experienced to purify most effectually all tainted apartments, ships, cloaths, &c. yet I have observed, that it does not destroy some species of vermin, particularly *Lice*. From which we might be led to imagine, that contagion is not propagated from *Animalcules*.

The third method of purification is performed by the addition of *Arsenick* to the materials of the *second* process, in the following manner. After carefully stopping up all the openings, and every small crevice of the ship, (as was also necessary in

in the preceding processes) a number of iron pots, properly secured, are to be placed in the *hold, orlope, gun-deck, &c.* Each of these are to contain a layer of *Charcoal* at the bottom, then a layer of *Brimstone*, and so alternately three or four layers of each; upon which the *Arsenick* is to be sprinkled, and on top of it, some *Oakum*, dipped in *Tar*, is to be laid, to serve as a match. The men, upon setting fire to the *Oakum*, must speedily leave the place, shutting close the *Hatchway* by which they came up.

From the known and experienced efficacy of these processes, it appears, that *fire* and *smoke* are the most powerful agents for *annihilating* infection; and, it may be presumed, even the *Plague* itself. This is, in some measure, agreeable to what we learn from the ancient records of *physic*. But the preposterous use, or rather abuse, of *fire* on such occasions, has caused its effects to be disregarded by some, and to be suspected of mischief by others.

The modern practice of burning large fires in the open air, in the streets, and about the walls of towns infected with the plague, or other contagion, is founded on principles groundless and erroneous; and hath therefore been experienced not only unsuccessful, but hurtful. Might

230 *Means of removing Infection.*

not this have proceeded from a consumption and a destruction, (during the continuance of such large and universal fires in a populous city) of that principle in the air, which is equally the food of animal life and of fire? And would not the mischief be still greater, at a time when a copious and constant supply of fresh air, fully impregnated with that principle of life, was so absolutely necessary in the foul and confined chambers of the sick? But even though we should allow that fires in the streets, and in the open air, may have proved hurtful during a prevailing contagion, it does not thence follow, that, when once a house hath been infected, and the patients removed from it, the doors and windows being shut, that such fires will then prove hurtful; or that, by this method of purification, all seeds of contagion will not effectually be destroyed. Experience, the surest test of medical truth, has fully ascertained the efficacy of the processes which have been described.

It is therefore much to be wished, for the benefit of the public, that this manner of purification might become a general and universal practice. Mankind need not be furnished with precautions against great and imminent dangers which they

see, or poisons which they know; the love of life naturally leads to shun them. But there is a necessity for guarding, by the most effectual measures, against such secret means of sickness and of death, as are not pointed out by the watchful instinct of self-preservation.

Whenever therefore persons die of a *spotted fever*, a *malignant sore throat*, the *small-pox*, or any distemper found to be communicable from the sick to others; for the preservation of the rest of the family, and of the neighbourhood, the corpse* ought, quickly after death to be removed into another room; the room in which they died should be aired, by having the windows opened, till a *charcoal* fire be kindled, with some rolls of *sulphur* upon it, after which both doors and windows should be kept shut for a considerable time, not less than eight or ten hours, till the room be thoroughly smoked.

I have known in several ships, where there are the fairest opportunities of trying and judging things of this nature, that the contagion of the *Small-pox* has been entirely stopped by means of *wood-fires*,

* I judge a recent *cold* corpse is not apt to communicate any taint, unless it be from the discharge of humours, from any of the outlets of the body, from running sores, or upon dissection.

232 *Means of removing Infection.*

sprinkled with *Brimstone*, kept burning, and closely confined, in the infected place. How useful then must this knowledge prove to the inland towns of *England*, where the dread and havock of that disease, among grown persons, exceed most calamities? In a word, a judicious and proper application of *fire* and *smoke*, is the true means appropriated for the destruction and utter extinction of the most malignant *sources* of disease. They are besides the greatest *purifiers* of all bad and tainted air; but of this I have already elsewhere given an account *.

With regard to the necessary precautions which are to be taken where there is infection, and while the sick are still in their chambers, I would for this purpose recommend chiefly the use of *wood-fires* in the apartments: for it hath been experimentally found, that the *smoke* of a wood-fire serves not only to lessen the force or violence of such infection, but is also an excellent protection against its being further conveyed. Thus, when from the situation of the fire-place in a ship, some smoke is apt to be frequently occasioned between decks, the men in her are observed to be more healthy.

* In my Essay on Preserving the Health of Seamen, Chap. ii. Sect. 2.

But

But to confirm this position; some years since, when the infection was so mortal in the *Royal Anne*, a guardship at *Spithead*, that many died of it in forty-eight hours illness, with a fever, and with violent bleedings from the nose, it was remarked, that none who slept within the reach of the *smoke* from the cook-room were infected. Hence it would appear, that a cold, raw, damp air increases the power and vigour of contagion*; which is further confirmed by the following relation given by Mr. *Ramsay Kar*, formerly surgeon of the *Torbay*, and now of the dock-yard at *Portsmouth*.

In the year 1755, when a pestilential sickness raged in the *North American* fleet, the *Torbay* and *Monarch*, both in equal distress, landed their sick at *Halifax*. The men, belonging to each ship, were in common daily visited by the surgeons of both ships; and in every respect of diet, regimen, and medicines, were equally treated by their joint advice. The cases and fevers appeared altogether similar. Notwithstanding which, there died of the men belonging to the *Monarch*, more every week, by one half, than of the *Torbay's* people. This unequal mortality

* This will further appear from Chap. ii. Sect. 1.

greatly

greatly astonished them. And the surgeons, after duly considering every minute circumstance with respect to the sick, found one point of difference only, to which the greater destruction among the *Monarch's* men could be ascribed. The latter were lodged in a large mill, without a *fire-place*; while the former were in some old houses, not nearly so well accommodated, but where they kept a constant *fire* of spruce wood.

Next to the *smoke* of wood, for purifying a tainted air, I esteem that of *gunpowder*. This I often use, as being quite inoffensive to the lungs. The *Cascarilla Bark*, when burning, gives a most agreeable scent to the chamber of the sick, so is at least an elegant preservative, and may prevent bad smells from taking effect. The steam of *camphorated vinegar* warmed is still more powerful for this purpose.

Besides correcting the ill quality of the air, and purifying the chamber, another good effect is produced from such steams and smoke, as are inoffensive to the lungs. As soon as the vapour becomes dense, the nurses and patients become desirous of the admission of the *fresh air* by the door or windows. Now it is certain, that the air in the chambers of the sick cannot be too often changed, provided the patient be well covered,

covered, and the curtains of his bed, if necessary, be drawn close. No argument is so forcible to obviate the danger of foul air in a room or ward, (occasioned by the obstinacy of nurses or relations) as ordering it to be frequently *fumigated* or *smoked*. A practice more frequent in other countries than in this, and of great benefit to the sick.

I shall, lastly, deliver my sentiments with regard to the purification of *goods, moveables, cloaths, &c.* which are suspected to harbour infection.—And I cannot but take notice, that the usual custom of *only* unpacking and exposing such materials to the open air, is in many instances insufficient to destroy the latent seeds of disease.

It will appear from the next chapter, that the *spreading abroad* of contaminated cloaths to dry, or to be aired, without a previous *fumigation* of them, may be of dangerous and fatal consequence. A damp air, we have already said, gives strength to contagion, and a dry wind may spread the mischief.—All such suspected substances ought therefore to be first *fumigated* in a close place, and in the same manner as an infected chamber; afterwards they may be spread abroad, and exposed to the air.

The following late incident serves to enforce this precept. A common labourer having died * of the small-pox at *Portchester*, his wife carried his late wearing apparel, after airing them, as she thought well, to the town of *Havant*, about nine miles distant. After permitting some weeks to elapse, as a security against the infection, she made a present of her late husband's waistcoat to a joiner's servant. This servant, soon after putting it on, took the small-pox, and died. And before his disease was discovered in the family to be the small-pox, (for which he was immediately removed from his master's house into a sort of *pest-house*) it was found that one of the children in the family, and two of her little companions who used daily to be carried to school by that servant, were also infected. This occasioned a general consternation in the town. But by making a proper separation of the sick from all others, and by taking other necessary precautions, the contagion, without extending itself further, was entirely stopt.

In infectious diseases, especially fevers, the *linen* of the sick, or such cloaths about them as will admit of being washed, ought never at first to be put in warm

* In April 1761.

water,

Means of removing Infection. 237

water, as it is dangerous to receive the steam that may hence arise. It is necessary to steep them first either in cold water, or in cold soap-lees, for several hours, that the filth may be washed off.

I have thus finished what I intended to offer, with respect to the means of purifying infected *places* and *substances*;—and shall, in the next chapter, proceed to give the most effectual methods of removing an infection, when already *received* into the body.

CHAP.

C H A P. II.

Means of obviating Infection received
into the Body. Treatment of in-
fectious Fevers.

14 Auguſt, 1761.

S E C T. I.

Of Infection.

Infection difficult to be controverted by negative proofs. Excretions of the ſick moſt liable to communicate the diſeaſe. Treatment of infected perſons. Degrees and ſymptoms of infection; its exciting cauſes, remedies. Means uſed to preſerve the attendants at Haſlar hoſpital.

THE words *infection* and *contagion* are by too many thought to convey the alarming idea of a plague, or highly malignant fever; but theſe terms are here uſed in a more general ſenſe, to comprehend all fevers, of whatſoever kind, that are imparted from one perſon to another, either by a near approach to each other,
or

or by the means of such substances as have imbibed the latent seeds of the disease.

This infection is more general than has been commonly supposed. Nothing is more common, than to hear a fever, or other distemper, pronounced to be free from an infectious disposition; and the attack of it upon a few attributed to very different causes, because the person himself, who judges in this manner, has had the good fortune to escape, as some others may have done, who were equally exposed to the infection.

This false manner of reasoning has done an infinite deal of mischief to physic, in other instances as well as in this; when, from a few exceptions, an attempt is made to overthrow the established maxims of the science. As for example; if the *Bark* should fail of curing an *ague*, or *Mercury* of removing a venereal taint, are we thence rashly to conclude, that either of those medicines will prove, in all other cases, ineffectual?

As there is no remedy, though the most sovereign in the world, which does not sometimes fail of success, even in cases where seemingly it is well adapted; so there seems to be no contagion yet known, that does affect all mankind indiscriminately. *Inoculation* for the small-pox sometimes

times fails to produce that disease, and yet no one questions its being contagious. I never found in myself the least symptom of an infection, although for several years I have daily attended people labouring under contagious diseases. And the young gentleman who was most exposed, by being constantly employed in bleeding, and superintending the other surgical affairs, in the *fever* wards of *Hasslar*, though he never used even the necessary precautions, but was greatly culpable in exposing himself presumptuously to danger, was also never in the least affected. But it does not thence follow, that the *Fevers*, during those times in the hospital, were not infectious, as there are the most positive proofs of the contrary.

An infectious disease is not therefore always such as the vulgar imagine it to be, a calamity which spreads itself to every person who approaches; the plague itself is not altogether of such a nature. It comprehends only a disease which in certain circumstances may be communicated to others: there are certain constitutions or habits of body which are peculiarly susceptible of infection, and each species of infection finds constitutions which more strongly resist it. A late incident will illustrate my meaning, and will, at the

the same time, demonstrate the impossibility of proving, *negatively*, a disease not to be infectious from the number of those who escape it.

In a ward where there were eighteen marines, five of them were seized with a severe *flux*, being infected by two seamen, who were warded with them. Among five hundred and ninety-two patients, then in the house, none laboured under this complaint, but in that ward. The five marines became themselves sensible how they got the distemper, though thirteen men, in a parallel situation, were never in the least affected by it.

Some *Secretions* are more apt to convey infection than others: in acute disorders the *Stools*, especially if very fetid, are most communicative of a taint; next to these the *Breath*, and lastly the *Effluvia* from the body.

When a person has received an infection, the treatment of the fever should be the same, whether the infection be acquired from a slighter or more virulent taint; or whether it be only a relapse.

The effect of contagion is often sudden and sensible. Some years ago I visited a lady in the *Bilious Cholic*, whose discharges upwards and downwards were intolerably offensive. A gentlewoman, only in pass-

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ing the room, was immediately seized with a retching and sickness, which continued twenty-four hours. The nurse, who attended, was suddenly seized with a giddiness and vomiting from the bad smell, which, as she expressed it, *reached into her stomach*. The vomiting became more severe at night, accompanied with a purging and frequent shiverings. By means of an *Emetic*, both evacuations were stopped. Notwithstanding which, for some days afterwards, she continued to have frequent *tremors*, and a violent head-ach, with a low irregular pulse; and did not recover so soon as the patient.

Such slight degrees of infection I have often observed to be derived from patients of a gross habit of body, when labouring under inflammatory distempers, and even other complaints.

A man was sent to this hospital, supposed to have a fever. He was *furiously* delirious, with a full quick pulse. Notwithstanding plentiful evacuations, this *delirium* continued for two months, with short intervals; when, understanding he had formerly been subject to it, we found his case to be plainly *maniacal*. A nurse, upon raising this person up in her arms, perceived an intolerable bad smell, and was instantly seized with shiverings, sickness,

ness, and head-ach. Finding herself very ill, she took a *vomit* in six hours afterwards, and passed the following night in profuse sweats, by means of a *sudorific* draught. Next morning the violence of the head-ach was but little abated; upon every attempt to move, she complained of a burning heat and pain in her forehead, and became giddy. Her inclination to drink was frequent, and her pulse low and quick. A *blister* was immediately applied to the back; as soon as the blister took effect, the head-ach and thirst entirely left her, and the pulse was calm. Next day she arose, and was well.

I have met with many similar cases of infection, received from putting *dead* bodies into the coffins. In particular, one man who from performing that duty to his messmate, was so ill, even after the operation of the *vomit*, as to require a *Blister*. In the course of a week, I once had two nurses infected by a person in the *Small-pox*. Both were seized, in like manner, with shiverings, sickness, and head-ach; the one upon receiving the patient's *breath*, the other upon making his *bed*. In one, a pain darted into her breast; in the other, into the breast, and *small* of the back. The complaints of the former were speedily removed by a *vomit*, though she

continued to have irregular returns of shiverings for three days afterwards. But in the latter, though the head-ach, sickness, and rigors, were greatly abated by the vomit, yet a constant heat and thirst, with a low pulse, and a violent pain in the breast, indicated the necessity of applying a blister to the affected part; which, next morning, removed all her complaints.

Those infections I call the *slightest*; in twenty such instances, I have not met with one that proved mortal, where the patient was properly treated; though, in many of them the taint proceeded from persons in the small-pox.

A person is often *immediately* sensible of his having received an infection from its first attack: in discoursing with several, who have been infected by patients in contagious fevers, they generally compared the first impression to an *earthy, disagreeable smell, reaching down*, as they expressed it, *into their stomach*, as from a grave newly opened, but not quite so raw as the cadaverous stench; and the effects of it, shivering and sickness, were instantaneous. It is a smell difficult to describe*, but is

* Some compare the smell to that of rotten straw. It often resembles the disagreeable smell of a person labouring under the *confluent* small-pox at their turn, though it is not so strong.

well known to the nurses and attendants about the sick, as it usually accompanies fevers of extreme malignity, and, with the peculiar discharges from the blistered parts, may be reckoned among the most constant symptoms of a *bad* fever.

But many are *not* sensible of any effect from an infection *at first*; it appears, by the observations contained in the former chapter, that an infection from a fever will sometimes continue about a person for many days, nay weeks, discovering itself chiefly by irregular *shiverings*, sometimes so severe, as to oblige the patients to have recourse to their bed once or twice a day; sometimes every other day. Among a number thus affected, it also appears, that such as are put into unseasoned chambers, or have sat down on the cold ground, lain in damp apartments, &c. are immediately seized with a sickness at the stomach, sometimes with a dangerous purging, and often with fevers accompanied with bad symptoms; which the others have entirely escaped*.

In infectious fevers the patients are very subject to *relapse*. Now, in an infected place, whether house, chamber, or ship, where the seeds of contagion are harbour-

* See chap. i. sect. 3.

ed, frequent relapses into fevers, even to the sixth or seventh time, are not unusual, and may justly be ascribed to the influence of the contagion. But in a clean hospital, as at *Haslar*, where all the bedding, cloaths, &c. of the sick, are purified by such methods, as we are certain do effectually destroy the seeds of this evil, relapses must be attributed to very different causes; accordingly, those persons are found to be chiefly subject to them, who are irregular, obstinate, and unwilling to submit to the proper confinement and restrictions of the house.

This may serve to evince the necessity of taking the utmost care of patients who are *recovering*, as I have remarked, that the irregular conduct of infected persons, and especially their getting out of bed, or going abroad too soon, renders them subject to a return of the fever.

The same *causes* which give rise to relapses, I am inclined to think, do sometimes *excite*, or render active, an infection, before received into the body, but so slight as of itself to produce no bad consequences, I am confirmed in this opinion by the quick and sensible effect of infection from bad fevers, when in such a degree as of itself to communicate the disease. But if a person perceives no symptom of an infection,

fection, till many days after having left the place of its abode, and is first taken ill of it immediately after having been wet with rain, exposed to cold or damp, or having been guilty of intemperance and excesses, it is probable, that these causes * have excited this dormant poison into action; and that, without their influence, it would never have affected the constitution. Be that as it will, and let this infection have remained inert for some time, either in the

* I have remarked many seamen, who belonged to infected ships, after having been several days at land, to be seized with their ship-fever, by over-eating, getting drunk, quarrelling, or the like excesses; and when they were sent to the hospital, I have found them covered with *petechiæ*.

The circumstance of the infection in the hospital, during the winter 1759, (as related in chap. i. sect. 2.) having been entirely confined to the men from *North America*, further corroborates this opinion. There were in *December*, that year, seven hundred patients in the house, two hundred came from infected ships, of whom above twenty were seized with the fever, after being some time in the hospital; having been received into it on account of other disorders. Thus for instance: a seaman, belonging to the *Neptune*, was placed, for a hurt in one of his legs, in a clean surgery-ward. After continuing there ten days, without any other complaint, he, by stealth, procured some wine, so became drunk, riotous, and quarrelsome, and next day feverish. He was twice blooded for this fever, which was supposed to be inflammatory, and the effect of his debauch; but the third day, when brought into the fever-ward, I found his body spotted, and his fever of the same malignant kind as that in his ship.

body, or in the cloaths, or other moveables about the patient, we cannot be too careful in guarding against its deceitful appearances, when once roused into action.

The *coldness* felt at first over the body, the shiverings, with slight sickness at the stomach, tend to confirm the mistaken opinion, that these are only the common symptoms of a *cold*, or sudden chill, or what the vulgar term an *ague*. But as, from such complaints, there is a just reason to apprehend an incipient fever, then is the time for the advice of the *Physician*, as improper treatment, or the delay of a few hours, may produce effects beyond the power of medicine to remove.

To all who are supposed to be infected by fevers, during this state of *rigors*, or chills, a gentle *vomit* is immediately to be administered, before the fever be formed, and before the fulness or hardness of the pulse renders its operation dangerous. If the *vomit* be delayed too long, and especially if *bleeding* must precede it, the most certain and favourable opportunity of procuring safety for the patient is past.

The effects of this antidote are so well known in the hospital, and have been so fully ascertained by our repeated experience, that those who are employed in

in the fever-wards, as soon as taken sick, have immediate recourse to an emetic, and it seldom fails to prevent the disease. I have found it equally serviceable in preventing relapses, when it is given immediately at the return of the *shiverings*. Let me add, that a loose *stool* or two should at this time be procured, either by means of the emetic, or of *clysters*.

The vomit administered was generally very gentle, and seldom exceeded from six to ten grains of *Ipecacoanha*. The patient should afterwards, when put to bed, take a sweating and quieting *draught*, containing five grains of *salt of hartshorn*, and from fifteen to twenty drops of *Thebaic tincture*.—At other times we have given five grains of *Camphire* every four hours, with large draughts of *vinegar-whey*. Eight persons in ten got quite well by this treatment.

But if the head next morning be not altogether free from pain, or the fever is still to be apprehended, something more is to be done, which I shall mention, after premising,—That it must always be remembered, in cases of infection, to pursue the most vigorous measures, as soon as possible; as in the first hours, as well as days,

days, of this fever, less must be trusted to nature, than in any other distemper.

We think no confidence should be put, at this period of the disease, in *alexipharmic*, or sweating medicines; in the boasted specific antidotes *mithidrate*, *treacle*, and the like, which, I am of opinion, in cases of imminent danger, ought not to be used, till after proper evacuations.

If the symptoms of a fever remain after the administration of the *vomit*, *clysters*, &c. or should an emetic have been altogether neglected, or unluckily delayed too long; or the patient have been injudiciously treated with *sweating* medicines, and *bleeding*, where the proof of infection is evident; recourse must speedily be had to *Blisters*; these are to be applied to the back, if the head or limbs are affected; and to the breast, should the pain have seized that part.

I do not know a more certain proof of a prevailing infectious fever, than that of twenty patients in fevers *blistered* at night, sixteen will next morning be entirely free from heat, head-ach, pain, and fever; provided the source of their infection be not so highly virulent as it was in the ship *Garland**, or in other such violent con-

* See chap. i. sect. 3.

tagions. Indeed we do not affirm, that such salutary effects would be produced while the patient continued in an infected place, or within the sphere of its * action. I have always, even in the worst infections, found this method of treatment more successful than any other recommended by authors, or that I myself have had opportunities of trying. And in relapses, where I have had the most frequent cases for fair trial, as also in the nurses, and other servants of the house, I

* Agreeable to the institutions of this hospital, all those who laboured under fevers of whatever kind, were separated from the other patients. They were kept remarkably neat and clean, having their linen often shifted, and even their beds once or twice a day, if requisite. None but the necessary attendants were permitted to enter into any of the *fever-wards*, which were usually fumigated every evening with *gunpowder*. When any person by having a flux, or otherwise, became offensive, he was removed to the greatest distance from others in the ward; and, near where he lay, the upper part of the window was kept open, and a pan of coals placed at his bed, in which the *cascarilla* bark was kept burning. None were permitted to use the bed-pan, or other utensils, which that person used.

When at any time the *flux* was prevalent, a ward was opened on purpose for the reception of men only in that disease. For the *small-pox* and *measles*, distinct wards and nurses were also set apart in the hospital; and no linen from those last wards were allowed to be washed in the common wash-house. So soon as a person was free from a flux, or the fever, he was sent into other wards appropriated to the reception of such recovering patients.

have

have been fully satisfied of its beneficial effects.

Most of the men sent from the *Garland*, and some other infected ships, were *blooded* before they came into the hospital; but this operation is always dangerous, in proportion to the virulence of the taint. Fevers highly malignant will not bear *bleeding*; and though this operation be not so dangerous, nay sometimes necessary, in slight infections, where there is a fixed pain in a part with a full or hard pulse, yet it is to be remembered, that, after this evacuation, less benefit is to be expected from the *vomit*.

Much has been said against the promiscuous use of *Blisters*, and their early application in fevers. But I have been surprised to find that in those ship-fevers there was seldom or never such a state of pulse, as forbid their use. What some mechanical writers in physic have advanced, concerning the theory of *blistering* applications, or their acting as *stimuli*, and hence always raising and encreasing the fever, is not applicable to those fevers of which we treat, where, according to the nurses phrase, the patient generally *received a cool* from the *blister*.

When the infection by these means has been removed, in twenty-four or thirty-six
hours

hours after the operation of the *blister*, the intestinal canal should a second time be gently cleansed, by giving *rhubarb*, with a small quantity of *vitriolated tartar*.

These observations claim the more attention, as not being *only* a few remarks made in private, or on any *one* particular fever, which might prove an exception to a general established principle in practice*.

* I have often thought, that publishing only one or two singular or particular cases, does more harm than good. If the effects of the medicine, or method prescribed, are said to be salutary, one or two trials of them cannot be thought sufficient to convince us, that nature, and the constitution alone, could not have performed the cure without their assistance. But if the case is published with a view to represent the bad effects of any particular medicine, or of any established method of practice, that may have proved evidently hurtful in this particular instance, what is the just inference from thence? Only this certain truth, that all the maxims of physic are limited, and that there is in it no universal infallible method, or remedy. And for this, there is at least one very obvious reason to be assigned, which is the peculiar *idiosyncrasy*, or constitution of each individual person; in respect of which not only food, but medicines act relatively. Hence *mercury*, *bark*, *opium*, and all other remedies, operate differently in various habits. In some, *rhubarb* will produce intolerable gripes, and to others, a simple dose of *manna* will become an emetic. Some are surprisngly affected with the smell of a particular flower, and eating the most innocent things hurts others; thus cheese, onions, and shell-fish, will produce sometimes *nausea*, vomiting, and symptoms as if poison had been taken. But why should I seek to multiply proofs of a thing so universally known? The just

They

They are the result of an attention to some thousand patients, whose cases are still preserved in the hospital.

But as the best proof of the efficacy of any method, is the success with which it is attended, I have here noted an account of all the nurses and servants in the hospital, who died from June 1758, to January 1760, that from hence their general healthiness may appear.

In the first six months only one nurse died, of whose case I kept no particular account. In the year 1759, died two labourers, and two nurses. With regard to the two former, how they were at first treated I know not. One of them, upon being taken ill, went to his own house, and there died of a fever. And the other I did not see till the eleventh day, when I found him covered with spots, even to the ends of his fingers; he had been a very irregular, drunken man. Of the two

conclusion then is, that approved methods and medicines are not to be discarded from practice, because, in some few instances, we are told, they produced unfavourable effects; and in such cases the calumny is often most unjustly heaped on the medicine, where part at least may be due to the temperament or *idiosyncrasy* of the patient, whose particular constitution it is the business of a judicious physician to study, as much as it is to acquire a perfect acquaintance with the *materia medica*; and, in his final result of judgment, to have taken both under due consideration.

nurses, the first was an old woman, who seemed to die merely of a decay of nature, without any just suspicion of another cause. The second died in the following manner, of an infection.

In the month of *April*, three months after the *yellow* fever had entirely ceased, two nurses, lodging in the same chamber, were seized with fevers, and both became yellow; one died, the other recovered. From a strict examination it was discovered, that they had concealed some shirts and cloaths belonging to the infected men from *North America*, which were afterwards taken from under their bed, and destroyed *.

Thus, in eighteen months, there died only five † persons out of more than an hundred who were constantly employed, during that time, in various offices about the sick.

This extraordinary preservation of such a number of attendants, resident in so large

* A similar case to this occurred in three nurses, that attended the *chirurgical* patients, who were successively infected by lying in the same bed; one of them, in whom an infection was not suspected, had a very bad *petechial* fever for near twenty days. From the other two the infection was speedily removed.

† There was another nurse taken ill in *November* 1759, but did not die till *January* following. The circumstance of her having been infected was somewhat doubtful.

an hospital, compared with the mortality which we have heard of in other hospitals, in ships, and at other places, can be ascribed only to these two causes.

The first was the speedy removal, and immediate *purification*, of the cloaths, bedding, &c. of every patient at his first admission; the smallest article of apparel, belonging to a person in a fever, not being permitted to remain with him in the ward, nor even in the hospital. For, as soon as received, he was directly stript, and all his cloaths, with their contagion, conveyed to the *smoke-house*, where the infection was effectually destroyed.

Another cause of preservation was the early use of the proper means that have been prescribed. There are now several nurses in the hospital, who have been five, six, or even seven times infected, and thus successfully treated; and I have often known two or three of them taken ill in a week.

I am apt to think, that an *infection*, from whatever source it is derived, first discovers itself by affecting the *stomach* and *intestines*. It is uncommon to find a case, which does not begin with *shiverings*, commonly with a slight *nausea*, often a vomiting. This state of shivering continues with some a shorter, with others a longer

longer time; after which a pain is often felt to dart with violence into some part of the body.

I have attended three patients in the same ward, and from the same ship, during their state of *Shivering* and *Chills*; in one the pain has attacked the head, in another it seized the breast, and in the third it has descended to the legs, so as to resemble a violent *Rheumatism*.

We are of opinion that a speedy and thorough *cleansing* of the whole *Alimentary* tube, by the means of a *Vomit* and *Clysters*; or even, perhaps, by a gentle, natural, supervening *Looseness*, removes the infection. Whereas a severe *Flux* indicates the mischief at this time to be fixed, and as it were concentrated in that canal; notwithstanding which it is still often successfully dislodged by an immediate emetic, or, if that should fail, by a blister, which, applied without delay to the back, sometimes stops this *Looseness* as effectually, as at other times it removes the head-ach, pain of the limbs, or breast.

S

SECT.

S E C T. II.

Of Fevers.

Of febrifuge medicines: antimony; contrayerva and Virginia snake-root; opium; tranquil state of body and mind. The common Appellations of Fever unsatisfactory: noxious vapours from the earth a frequent cause of fevers: study of different fevers recommended.

FEVERS being of all diseases the most destructive to mankind, it is at least to be wished, that such a *specific* was found for *Continual* fevers, as the *Bark* is for *Intermittents*. This is to be sought for, perhaps, in *Antimony*. But even when obtained, much, as at present, would still depend on timely and judicious evacuations, by bleeding, blistering, vomits, purges, &c. all which may do mischief when unskilfully advised, or when administered at improper season; but with prudent care, become the most certain means of relief hitherto known from this fatal distemper.

I have, in many hundred cases of fevers, tried different *Antimonial* preparations, and am convinced, there is in some of them a
pow-

powerful febrifuge virtue, even when they act as an *Alterative*. Many antimonial medicines are however entirely divested of such a virtue, whilst some possess it in a smaller degree, as *Vinum Antimoniale*; and others in a more eminent degree, as *Tartarum Emeticum*, which is also exceeded by other *Antimonial* preparations.

Antimonials should be exhibited in small doses, frequently repeated. I often add four or five grains of *Camphire* to each dose, at other times the like quantity of *Nitre*. But, when much dependence is placed in *Nitre*, it should be given by way of *Clyster*, as well as by the mouth. When *Antimony* ruffles, or purges, *Electarium e scordio*, or even *Philonium Londinense* should be administered with it. The *Contrayerva* and *Virginian snake-root* have been much reputed for their *Alexipharmic* qualities. Both roots are apt to be sandy. An *infusion* made of two drachms of each, for four or five hours, in a pint of boiling water, strained and freed from the dregs by standing, and taken to the quantity of two ounces every four or six hours may be given in *low* fevers; to which, according to the judgment of the prescriber, and state of the pulse, may be occasionally added, either *camphorated* or *distilled vinegar*, and sometimes *Rhenish* wine. But

neither of these roots are possessed of any *specific* febrifuge virtues.

Opium, next to *Antimony* and the *Bark*, is one of the most useful medicines that can be used in fevers, though it cannot perhaps be brought under the denomination of a febrifuge, as being chiefly directed to remove some of the symptoms of fever. In all violent evacuations, whether by hæmorrhage, vomiting, or purging, *Opium* affords the most immediate relief. In a small quantity it corrects the too violent operation of *Antimony*, the *Bark* and other *febrifuge* medicines, and frequently improves their virtues, especially as *sudorific*, *Opium* being the most certain *sudorific* pharmacy yet knows. It is particularly useful in the *decline* of a fever, when the patient's strength and spirits are almost exhausted: as a person in perfect health, wearied by excessive labour, feels immediate composure of spirits, and a pleasing refreshment, from taking an *opiate*; so a sick person, almost spent by an harrassing fever and long want of rest, feels the greatest satisfaction on taking *Opium*, which, at the same time, proves the best *restorative* of his exhausted strength and spirits.

Some entertain a prejudice that *opiates* relax and weaken the constitution, but such

such must not have had much experience of them, in persons reduced by long and severe fevers, when nature calls out for something to compose and give rest. Some few constitutions cannot bear *Opium*; yet, in general most, when reduced to so low a state, are, even on first taking it, so sensible of its good effects, that they earnestly solicit a repetition of it every night, until they are able to rise out of bed. There seems an analogy between *Wine* and *Opium*; the abuse of either may relax and injure the constitution, but both, when judiciously administered, may be ranked among the best remedies for fevers. I have made repeated trials of *Bark* and *Opium* as restoratives, and am thence of opinion that the *restorative* virtues of the *Opium* exceed much those of the *Bark*.

In a former note* I observed, that medicines act variously in different habits, and always with an effect relative to, or as directed by, the constitution. On this subject of administering proper remedies in fevers, I have further to add, that in the corporeal frame, there is a wonderful facility, which divests some sorts of poisons of their virulent and noxious quality, by means of their long use. And, in the

* See the preceding section.

same manner, many excellent medicines loose their quick or effectual operation, when the body has once become habituated to them. And this is most frequently the case, when such medicines pass the stomach [without occasioning a sickness. If a person takes as much *Jalap* as will purge, and every day repeats the same dose, he will, in all probability, find that quantity of *Jalap* will, at length, by constant use, abate much of its purgative quality. *Cream of Tartar* has, with some, very singular effects; at first it is laxative, till the person has taken it for some days, and then it acts as an astringent; the purgative quality is again restored, by increasing the dose. In physic we are very sensible, that some of the best remedies may, in like manner, by frequent use, become much diminished in their virtues, particularly *Antimony*, *Opium*, and the *Bark*.

In *acute* diseases, for these reasons, all medicines of an important efficacy, when continued, ought gradually to be augmented in the dose, so as not greatly to ruffle the stomach or bowels. As in diseases of longer duration, prescriptions should, after a proper time, be changed for others, new to the constitution of the patients.

Further, not only in hospitals, but in all private families, persons in fevers ought to be kept separate from others, and free from the idle visits of over-officious friends, and from all disturbance and noise. This ought to be done more particularly, with a view to the enjoyment of that tranquil state of mind, which must co-operate with the mechanical salutary effects of medicines towards a recovery. I have known many patients, who may be said properly to have been killed by the shock or surprize from an account of the death of a friend, or of some person who had been in the same state that they imagined themselves to be in. Those who neglect the *Medicina Mentis*, or a due attention to the passions of the mind in sickness, are inattentive to one of the most important aids towards the relief of it. For if the most wholesome food does not nourish, when the desponding mind is oppressed with grief and fear, neither can it be expected that with a person under the influence of those depressing passions, the most appropriated medicines will produce their salutary effects.

Some may suppose, that a medicine, salutary in one fever, may prove hurtful in another, or even in the same fever in a different climate or country; that *Anti-*

monials may, perhaps, be serviceable in *Inflammatory* fevers, but hurtful in what are called *putrid*. However, in every *reputed* species of fever, *Antimonials* have been given with success, from a slight *Cold* to the severest *Plague*. A late *English* ambassador at *Constantinople* gave a quantity of *Antimonial* preparations to the priest of the *Plague-Hospital* in that city, in order to try their effects. They were administered to a great number of patients in the *Plague*, and, as the priest imagined, with benefit; but, unluckily, during the course of these experiments, the priest himself died of a fit of the *Stone*, after having been *twice* infected with the plague, and having escaped.

The *common names* of fevers, as I have elsewhere shewn, are too unsatisfactory to be regarded in practice; being founded chiefly on vague and theoretical opinions of their causes and effects. Physicians, who have had the most frequent opportunities of seeing numerous patients in fevers, have always found great difficulty in arranging their cases under the common appellations. An attempt of this sort has frequently led them into absurdities, as it is certain, that almost all these fevers may proceed from one and the same cause.

Thus

Thus Dr. Merli, in his monthly description of the contagious epidemic fever at Naples, in the year 1764, of which I have given a more particular account in my *Essay on the Diseases of Hot Climates*, observed, that “in the month of May it put on the appearance of a *Putrid Verminous* fever: in the month of June it was a *Putrid Inflammatory Nervous* fever.” We should have been at a loss to have conjectured the meaning of these terms, did he not in another place say, “This mischief, contagion, poison, or whatever name you are pleased to call it, produces in some a *Malignant Continual* fever, in others a *Malignant Double Tertian*, or a *Malignant Bloody Flux*. It sometimes attacks the *Head*, at other times seats itself in the *Breast*, in the *Kidneys*, or in some of the *Bowels*, and wherever seated it produces the most violent and malignant symptoms.”

From one cause, from the same infection, I have frequently known to proceed what may be termed, from outward appearances, the *Yellow*, *Petechial*, and *Miliary* fevers, and, while in a few the contagion assumed an *Intermitting* form and was mild, in others it raged with a *constant* and violent fever. Next to *Infection*, the most frequent cause of general and mental fevers,

fevers, is perhaps the *noxious vapours* exhaling from the *earth*, and the offensive *polluted air* in unhealthy or marshy places. Does not this vapour act like an infection received into the body, and may it not be expelled by the same means?

In *England*, and in other parts of *Europe*, according to the temperature of the season, and the different pernicious qualities of the soil, the diseases thence arising are either *Agues*, *Fluxes*, or *Fevers*, the latter being, for the most part, of a *low* and malignant nature. And there are many distant unhealthy parts of the world, where strangers are, from the very same causes, very liable to be attacked with distempers which prove often fatal.

At *Senegal*, in the rivers *Gambia* and *St. Domingo*, on the coast of *Guinea*, at *Carpenter's River*, near the *Mosquito* shore in the *West-Indies*, and in many other places, almost all *Europeans* lose their colour and appetite, becoming yellow, and troubled with sickness, or indigestion. Gentle *Vomits* are found very suitable to the constitution, and to the diseases in those climates.

The fever, with which they are seized, begins sometimes with a *Delirium*, oftener with a vomiting; it will not bear the loss of much blood; gentle *Vomits*, *Blisters*,
An-

Antimony and *Camphire*, with the *Bark*, are the best remedies for it, as well as contagious fevers. If the patient, after the application of *Blisters*, still continued very ill, and was delirious, with a low pulse, some have empirically given from five to ten grains of *Calomel* joined with *Camphire*, which was said to remove the *Delirium* *. This circumstance would not have been mentioned (being a practice we cannot recommend, if I had not been informed, by some judicious and authentic accounts lately sent me from the *East-Indies*, that *Mercury* hath been experienced a most useful medicine in the *Hepatitis*, after the inflammation had been somewhat abated by bleeding, and the neutral saline medicines. And to the use of the *Mercurius Alcalifatus*, many of our troops in that part of the world have owed their preservation in that disease.

* Dr. *Whytt*, late professor of Medicine at *Edinburgh*, having desired me to try at *Hasslar* hospital, in fevers accompanied with *Delirium*, restlessness, *Tremors*, convulsions, and great agitation of the nervous system, with a sunk, or at least not full pulse, the effects of a fomentation of hot water by itself, or with a very little vinegar, applied to the legs and feet, by means of flannel cloths, renewed every five or ten minutes, I have often put this method in practice; and, when continued for some time, the patient commonly became calm, and fell into a sleep.

We

We would, indeed, advise all those, who intend to pursue the study of physic, to peruse the histories of such observations as have been made on the fevers of different countries, and both the ancient relations of this dislemper, and many excellent accounts of it published in our own times. For to the publication of such writings, all improvements in the *healing art* are entirely owing, notwithstanding the contempt of the ignorant, the envy of the malevolent, and the criticisms to which authors are exposed.

Knowledge in physic can only be attained by a series of observations; we must therefore add to our own experience, that of men who lived before us, or who practise in different places, carefully separating *experienced* truths from *hypotheses*. By the help of this acquired knowledge of what has been discovered from age to age, or in different countries, by the inspection of nature and diseases, the mind becomes stored with experimental truths and observations. And a physician, thus qualified, will be enabled to take a comprehensive view of the operations of nature, and of diseases under various shapes, as influenced by climate, season, weather, constitution, and medicines.

A judicious *synopsis* of the writings on fevers, in a chronological series, would be a valuable book. Treasures of useful knowledge might then be found in one volume, where, disengaged from conjecture, such naked truths should only appear, as are confirmed by experience and observation. We might there trace the gradual advances which have been made towards a more complete knowledge, and a more successful method of treating this disease, from the time of *Hippocrates*. This book would perhaps not comprise an abridgment of above two hundred authors, as there are scarcely above that number whose observations would deserve a place in it. And although a very striking contrast would appear in the *theoretical* opinions of authors, yet a nearer resemblance, than perhaps is expected, might be found in the *facts* they relate. A better judgment might thence also be formed of the propriety of peculiar denominations given to different fevers by the ancient writers; and of the reasons why, in almost every age, the appellations of fevers have been changed; whether also fevers are essentially different in different countries, varying likewise their nature at different periods of time. Conclusions drawn from partial facts, and an imperfect experience of things,

things, would there be distinguished from more universal and better established truths. And symptoms merely accidental, or which are only the immediate forerunners of death, would be distinguished from the constant and essential signs of the disease. Perhaps, also, the influence of a favourite opinion, or of a pre-conceived fancy, on the writings of some, even of our best instructors, such as Sydenham and Morton, would be more clearly perceived.

S E C T. III.

Of Fevers.

Description of Petechiæ in fevers. Prognostics in fevers. Weak state of the body after a fever. Restoratives.

HAVING often made mention of *Petechiæ*, I shall now describe the appearances on the skin, that were meant by this term. Those *black* and *purple* spots, or *Petechiæ*, which are observed at the fatal period of a malignant *Small-pox*, I have not commonly met with in other fevers, though sometimes, where there was a *bad* fever, I have seen black and roundish

roundish smooth spots of blood, in the interstices of a small *miliary* eruption. But oftener the *Petechiæ*, which we have remarked, were of a pale red, resembling a *rash*, appearing sometimes to the eye elevated, but commonly found to be flat by the touch. On the breast, back, loins, and thighs, they appeared often of an irregular figure, and so numerous sometimes, that they seemed to *streak* the skin. In some patients, the *Petechiæ* were visible, without once disappearing, for five or six days : but their presence is generally more inconstant, and often not observed, unless carefully attended to, on account of their frequent vanishing, and of their faint appearance at times, under the skin.

These appearances in malignant fevers are generally supposed not to have been taken notice of by the ancients. But *Hippocrates* describes spots similar to them ; and *Actius* expressly says, that smooth spots, resembling flea-bites, appear on the skin in malignant fevers.

Some authors, from a supposition of the great *Dissolution* of the blood in *petechial* fevers, and from another supposition, that *Blisters* encrease the *Dissolution* of that fluid still more, have forbid their application in such fevers. But the experience of the
most

most eminent practitioners does not support those theoretical opinions*.

No fever can be deemed malignant from the appearance of spots alone, it must be accompanied also by other bad symptoms: a *spotted* fever is generally attended with a low sunk pulse; the patient is either comatose, delirious, or both, or at least is slightly delirious at times; his countenance is either bloated, or flushed with a pale red; and he frequently labours under an oppression of the breast with peripneumonic symptoms.

I have sometimes not been able to form any *Prognostics* of the fever from those *Spots*, because of their extreme mutability in form, colour, and size. When a person was first brought into the hospital, there has often been observed a number of smooth, black, and purple spots on the

* *Riverius* treats of the *petechial* and *pestilential* fevers in the same chapter, where he says,

Ubi maxima est malignitas, unicum vesicatorium non sufficit, sed plura admovenda sunt; soleo ego in magna morbi scævitia, quinque locis admovere, cervici nimirum, utrique brachio, parti interiori inter cubitum et humerum, et utrique femori, parti etiam interiori inter inguina et genua, cum felici successu.

Riverii opera, p. 541.

And *Etmuller*, treating of the same fevers, says, Si ulla est febris in qua vesicatoria conveniunt est imprimis *petechialis*. P. 365.

surface

surface of the body, especially on the back and loins. After he was put to bed and refreshed, the spots were sometimes hardly discernible, and at other times they had turned red, and felt rough or scaly. Nay, so mutable at times was the nature of some spots, that I have remarked a glass of wine given to the patient, or a sudden alteration in the passions of his mind, had an effect to change their colour, and sometimes to occasion their disappearance, when a roughness was perceptible in their place.—This naturally leads me to say somewhat concerning the *Prognostics* in fevers.

Experience only, joined to a natural medical sagacity, can render a physician eminent for his *Predictions* in fevers; because there is no constancy, or invariable uniformity, in any one febrile symptom, on which such predictions can be grounded. The *Pulse*, in which so great a confidence is placed in fevers, sometimes points out but a small danger, even while the patient approaches near death. When felt in different places, physicians sometimes find it various, and in the same place often altered after an interval of an hour or two.

A just prognostic can therefore only be formed from a general view of all the occurrences and symptoms about the sick,

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and by making a proper allowance for the greater degree of certainty and fallibility in each. Thus, the countenance of the patient, especially the eyes, the posture in which he lies, the manner in which he breathes, speaks, eats, drinks, or swallows; the state of the pulse, of the tongue, of the urine, and of all the other excretions, compared with a review of what has passed, at once strikes the mind of an experienced physician with a sense of danger or security.

I never had an opportunity, at *Hastar* hospital, of seeing fevers rise to such a degree of malignancy as to produce *buboes* *, livid blotches, or mortifications, except in dying persons. We have sometimes observed, in very violent infections, a swelling of the *parotid glands*, which, for the most part, was unattended with a fever; notwithstanding that, such as were seized in this manner commonly died. *Aphthæ* were unfrequent symptoms. Amongst the *worst* signs and appearances of such contagious fevers as I have had occasion to treat, were a sunk, lifeless state

* In the beginning of this year, I had occasion to see, at *Winchester*, many of the *French* prisoners, who were infected with a fever of a very malignant kind, attended with *buboes* in the arm-pits, and other pestilential symptoms. They were put under the care of Dr. *Welsh*, an eminent physician in that city.

of the eyes, in some a most offensive stench from the breath, and from the whole body, a noisome discharge from the blistered parts; sometimes spots on the body, at other times an universal yellowness.

I have remarked in several instances, that persons, who have once been infected, though speedily relieved by a vomit and blister, yet afterwards became, for some time, sickly, and afflicted with irregular complaints. This happened chiefly in weak constitutions, to hysterical women, and in very malignant taints.

This leads me to take a view of the *state* in which the constitution is often left after a fever, when it has been violent, or of long continuance: a subject which ought to be well understood.

Many, especially women, and those of a delicate habit, are reduced, by fevers, to an extreme degree of *imbecility*, accompanied with a frequent *purging*, particularly during hot weather. As this purging is merely the effect of weakness, too much care cannot be taken at first to check it, not by *vomits* or *purges*, which, in such circumstances, prove hurtful, but by *strengthners*, by *wine*, by *tinctura japonica*, toasted *rhubarb*, and tincture of
T 2 *bark*,

bark, with the addition of a few drops of *tinctura thebaica*.

Others are, at this period, subject to a constant teasing *cough*, proceeding altogether from their weakness. I have opened several who died exhausted in this condition, and who, from their incessant cough and spitting, great weakness, frequent purgings, difficulty of breathing, and other symptoms, were supposed to have died of a *consumption* of the *lungs*. But I found these symptoms (where the case had not been *peripneumonic* or *pleuritic*) generally proceeded from the *serum* of the blood extravasated into the *tela cellulosa* of the lower extremities, and into the *cavities* of the breast and belly.

The *ædematous*, or swelled legs, common in such cases, are not, as the ancients supposed, distended with *phlegm*, nor are they inflated with *air*, but enlarged by *water*. When such swellings disappear, as is usual by lying in bed, or in an horizontal posture, this water is returned into the *belly*, and often into the *breast*, where it occasions, if in great quantity, an incessant cough and *stitches*.—I say, if in a *great* quantity, being persuaded, that a *small* quantity of water, especially in the *belly*, gives little or no uneasiness. But generally

nerally in those persons there was a great deal of water found in both those *cavities*, and in the legs; so that such patients apparently died of an universal *dropfical* or *watery* habit.

It is an admirable observation made by the judicious *Sydenham*, that the best remedy for a *Cough*, after a fever, is a rich nourishing *Wine*: a cordial which, I think, should never be omitted at that period; to which we may add, a bitter of the *Bark*, and every morning the use of warm *Milk*, with a spoonful of some agreeable *spirituous* and *diuretic* water put into it. Where there was no flux, but a constant and wasting spitting, I have sometimes given a few grains of *Calomel* and *Rhubarb* with a good effect, by way of a gentle *hydragogue* purge.

When this state of weakness becomes insuperable by milk of women, of asses, or of cows, with the restorative aid of *Bark*, wine, gentle exercise, and change of air, and by *diuretic* and *hydragogue* medicines; the scene of life is often closed with one of the most affecting spectacles of mortality. The habit and look of the patient bespeak a quick approach of death; while, from the water spit up in form of *phlegm*, to the quantity of a pint or two daily, (as I have frequently observed it,)

or evacuated by other unnatural drains, he becomes so wasted, as to bear the resemblance of a mere animated skeleton; though fully possessed of every faculty of the senses, and of a sound mind. Such a person is apt, at this time, to become fondly tenacious of life, and to conceive the most eager expectations of it from every change of weather, diet, or of medicine, or from any case, similar to his own, favourably represented to him. One good and refreshing sleep, obtained after a tedious night of watching and anxiety;—a shifting of the pain from one part of the body to another, where it is become more tolerable—a short respite from the cough—an abatement of the purging—the return of a longing and false appetite, with more calm spirits—all of these conspire to flatter him with pleasing, but delusive hopes, until the scene is closed, and the curtain drops, which separates this world from his view.

SECT.

S E C T. IV.

Dissections.—Of the blood.

Appearances after fevers on dissection. Component parts of the blood; its gluten. Various modes of morbid extravasation. Conjecture on the purulent state of the blood in fevers.

WE shall next examine the appearances on *Dissection* in such as die of contagious fevers.—In the few I have opened, very large collections of *Matter* were generally found in some of the cavities of the body.—In a man who died on the eleventh day of a *yellow fever*, whose body emitted no bad smell thirty-six hours after death, and was still yellow, I found all the *Bowels* of the *Abdomen* sound; the *Liver* and *Spleen* were remarkably so, as also the *Stomach* and *Intestines*. There was no suffusion of the *Bile* either in the *Intestines* or *Stomach*. The *Gall-bladder*, of the natural size, contained the usual quantity of *Bile*, somewhat thicker than common, and *grumous* *.

* In others, who died in this *yellow* state, I have found the *Bile* in the *Gall-bladder* of a thick roapy consistence, like *Pitch*, but never saw the *Liver* in the

Upon examining further, his disease was found to have lain wholly on the left side, where, within the *Breast*, was found near a quart of yellowish *Water*, in which were many large flakes of yellowish *Gluten*, appearing, by comparison, precisely the same with the thick *Pellicle*, which had covered the blood taken from his arm. These flakes bore in several places a resemblance to a *membranous* substance beginning to be converted into a purulent jelly. The *Pleura*, both on its inside and outside, as also its continuation, the investing *Membrane* of the *Lungs* (which, in some parts, was greatly thickened) were covered with cakes of this *Gluten*, hanging in some places loosely, in others adhering more strongly; and all in different states of yellow or purulent corruption. The right cavity of the *Breast*, and all the other parts of his body, were found intirely free from disease.

His complaints had been chiefly in his *Breast*; and a small quantity of *Blood*, taken from him two days before his death, was covered with an impenetrable, yellow, thick *gluten*; the *red* portion below it being quite loose.

least affected. I at first, in several bodies, opened the *Head* only, but afterwards judged, that all the *Cavities* ought to be inspected.

In

In those fevers I have also seen the disease entirely confined to the *Heart* and *Pericardium*. In one, who died the tenth day of the fever, without having been yellow, a quantity of *pus*, and *purulent* crusts, were found mixed with the water of the *Pericardium*. The *Heart*, in different places, was excoriated, and, together with the inside of the *Pericardium*, was lined with a thick *Membranous Cake*, similar to that already mentioned on the *Lungs* and *Pleura*. In some places, this cake had a purulent, in others a gelatinous appearance, exactly resembling the *coagulum* of the blood. His complaints had been a great oppression on the breast, and an extreme difficulty of breathing. In a third person, who died on the thirteenth day of the fever, above two quarts of *pus* and *purulent* jelly were found in the cavity of the *Belly*. The source of such an extraordinary quantity of *Matter*, was not from any preceding inflammation, nor any *Imposthume*, that we could discover; but from innumerable ulcerations on the surface of the *Intestines*, *Omentum*, *Mesentery*, and *Peritonæum*. Neither did those ulcerations (or excoriations, as they rather appeared in several places) seem to be the primary fountains of the *Matter*, but

but to have been occasioned by its acrimony.

This *purulent* appearance seems to arise merely from an extravasation of one of the component parts of the blood, the *Gluten* or *Coagulable Lymph*, blood taken from persons in a fever, and frequently even from persons in perfect health, after standing in a clean vessel for a short time, commonly separates into three distinct portions; *viz.* the *Serum*, or water of the blood, the *red* concreted mass, and a viscid pellicle, termed the *Size*, which spreads itself on the top of the *red* concretion. Some time ago, when making experiments with the blood taken from persons in the *Scurvy*, I was surprised to find it often covered with that *fizy* crust. This induced me to extend my experiments to large quantities of blood from different subjects, which I had opportunities of inspecting at once in so large an hospital. For this purpose I one morning ordered ten patients in the *Scurvy* to be bled, taking two ounces from each. A larger quantity was taken, for its inspection, from two men in health. That day I had occasion to prescribe bleeding to a woman in *Labour*, two hours before her delivery, to a girl of sixteen years of age afflicted with a *Lunacy* proceeding from the *Chlorosis*, to three pati-

patients in the *Rheumatism*, and to a person labouring under an obstruction of the *Liver*.

From a nice comparison, and an examination of the different blood, I found in general, that the more *size* there was on the top, and the thicker and more viscid this white *Pellicle* shewed itself, the *Concretion* below it was of a more loose coherence. This was not so observable, when only some slight white streaks appeared on the top. But when much *size* had separated itself, the *red* mass became very soft at the bottom of the vessel; and less compact in its different parts, in proportion to their distance from the surface, towards which this whitish portion had ascended.

From this, and from other experiments*, it appears, that this crust or pellicle is the natural *Gluten*, or cement of the blood (called by some the *coagulable lymph*), which becomes strongly disposed, in certain circumstances and diseases, to separate itself. And whereas the *Serum* and *red* concretion are easily incorporated together, it will be found, that this glue, after its separation, becomes immiscible with either. We have, by gentle drying, con-

* See the analysis of the blood, by Dr. Davies.

verted it into a perfectly tough, elastic membrane; and by the means of a small portion of the red mass, being left adhering to it, into a substance resembling *muscular* flesh; and it is capable of undergoing various changes into corruption, in the same manner as either of these.

Now, I can see no reason why this *Gluten*, in its morbid state, may not separate itself from the circulating blood, and be deposited in the cavities of the body, as readily as the *Serum* does in dropfies; the former having always a less disposition than the latter to incorporate with the mass.

In dissecting persons who died of *Fevers* in *London* and *Minorca*, and where no infection was suspected, appearances similar to these have also fallen under the inspection of those accurate anatomists Drs. *Hunter* and *Cleghorn**. Hence it may be presumed very difficult to distinguish fevers that are produced by infection, from some others. I cannot however be induced to think, as those gentlemen seem to do, that these preternatural substances, which were found in the cavities of the body, are the *Consequence*, but rather that they are the *Cause*, of the inflammation and exco-

* See *Cleghorn* on the diseases of *Minorca*, p. 248.

riations, I believe these substances to be at first diseased, extravasated *Gluten*, and conjecture their different states greatly to depend upon the different times at which they were deposited.

I have remarked, in a variety of dead bodies, three different kinds of *Extravasation*; these occurred in such as had died of the *Scurvy*, the *Consumption*, and of *Fevers*. In the former of those diseases, red, coagulated blood is found extravasated in almost all parts of the body, not only into the *Tela Cellulosa*, but into the *Bellies* of the muscles, particularly of the legs and thighs, which often become quite stuffed, and even distorted, with large *grumous* masses. The intestines and mesentery are often spotted also with extravasated blood; and I have seen large *Ecchymoses* on the stomach. Those appearances, at first sight, resembled so many distinct *Mortifications*, and by this appearance some anatomists have been deceived; but, upon a nice examination, the texture of the parts is found to be sound and firm. There is likewise, in that disease, sometimes an extravasation of *Water*, chiefly collected in, and always, when in the legs, confined to the *Tela Cellulosa*.

But whereas in the limbs of *Scorbutic* persons, it is extremely difficult to make
a good

a good dissection, by reason of such quantities of extravasated *Blood*, that everywhere obstruct the operator; so, on the contrary, the lower extremities of those who have died *Consumptive*, with swelled legs, are, of all other subjects, in the best state to afford a satisfactory view of the *Muscles*. The *Water* enclosed in their legs having insinuated itself, by passing in the *Tela Cellulosa*, into the spaces betwixt the muscles, the muscles are easily separated from each other; and their several origins and insertions may be distinctly traced, by means of their having been cleansed and washed by the water in the investing *Cellular Membrane*. Thus there are *extravasations* of three sorts; viz. first the *grumous* mass in the *Scurvy*; and this I have often remarked where no *Serum* was observed. Secondly, the *Serum* alone in *anasarcous* swellings. The third and last is what was taken notice of in those who died of *Fevers*, being the *Gluten* of the blood, accompanied for the most part with some *Serum*, both of them altogether confined in the large *Cavities* of the body.

I conjecture, that in those fevers there is always an *Ulcerous* or *Purulent* disposition in the blood, and that this *Gluten*, or *Coagulable Lymph* is greatly diseased. I have

have frequently seen it have a true purulent appearance soon after it was drawn off, when the patient seemed not very ill.

And I further conjecture, that the mischief often lies within the *Breast*; as also that the great benefit derived from the very early application of *Blisters*, in a great measure flows from so many *Ulcerations* and *Vents* being timely provided for the free discharge of those purulent and tainted particles from the body.

If an *Infection* depends, as many have imagined, on the *Admission* of certain foreign *Particles* into the *Blood*, this *Gluten* seems to be its more immediate seat, to be primarily affected by it; and a discharge of this, as though by washing those particles out of the body, tends in a great measure to remove the disease.

It is an observation of the best practical writers, that *Issues* and *Setons* are most excellent preservatives against receiving an *Infection*, nay, even that of the plague itself. And indeed a *Suppuration* and plentiful discharge from a proper *Ulcer*, whether produced by nature or by art, seems to open a channel the best appropriated for an exit out of the body, to some of the most malignant poisons. Thus, the most favourable *Crisis* in the plague, and in most pestilential fevers, happens when nature
excites

excites Tumors kindly suppurating in the groin, or arm-pits, by whose beneficial and plentiful discharges, the deadly poison is expelled from the constitution*.

I have observed it to be among the most certain characteristics of the worst fevers, that the *Blisters* either don't rise and fill, or discharge such yellow, greenish, foetid, and highly offensive stuff, that even experienced nurses could give a pretty certain conjecture from the blisters of the different degrees of malignity in the fever. We have more than once endeavoured to conceal the bad state of some patients in the hospital; but a discovery was always made of their condition in the wash-house, from the linen sent there stained with the Discharges from the blistered parts. And, indeed, a careful inspection of the state and discharge from the *Blisters*, together with their effects, furnishes us, in those diseases,

* Let us take the definition of the *pestilential fever* from a very great physician:

Febris pestilentialis est acutissima, a miasmate venenato orta, ac nisi vigore motuum vitalium venenam per bubones et carbunculos cito propellatur, lethalis. Hoffman. med. rat. system. tom. iv. sect. i. cap. 12. De febre pestilentiali.

There is a remarkable passage in *Galen* to this purpose: Ex febre pestilenti omnes evasisse quibus exulcerationes in variis corporis partibus contigerant, evacuata nimirum per ea ulcera materia morifica. Lib. 5. meth. med. cap. 12.

with

with some of the most certain diagnostics of their nature, and prognostics of their event.

S E C T. V.

Of Infection.

Infection frequent in families, boarding-schools, and places unsuspected. Opinions concerning its existence in different fevers. Fatal consequences of too rashly denying its existence. Abstruse nature of infection.

AN infection, that dreadful source of sickness, upon which we have laboured to throw some useful light in defence of mankind, against mortal and consuming diseases, is not confined to armies or fleets, in ships or prisons; but it elsewhere, in places often unsuspected, exerts its malignant influences.

When a nurse, attending a patient in a fever, or when two or three persons in the same family, are seized with a similar fever, it is attributed to cold, fatigue, and grief, or the like causes, which strongly dispose the constitution to receive, and which animate, the taint. When such diseases attack (as I have known) a board-
U ing-

ing-school of boys or girls, the fatal distress is often ascribed to causes which were not in the least accessory. Of this there was a late instance in a large neighbouring town, where a fever, in one of those schools, was judged not to proceed from infection, but from another cause, because it attacked young ladies of a certain age only. The truth was, it seized many of the young ladies in that house alone, and several died.

A more recent instance of this occurred also in a large school near one of our principal seminaries of learning; a fever lately prevailed among the young gentlemen, which, though of so mild a nature as not to prove fatal to above one or two, yet was evidently infectious, and affected only those who were confined in the same school, but did not extend its influence among the inhabitants of the town.

Fevers have often no peculiar or *characteristic* symptom by which they are known to be infectious; in general, however, a fever may be deemed so when in large families, colleges, or boarding-schools (where numbers live in the same house) several are seized with it; the skin in some becoming variegated with spots, or yellow, the head being much affected, and the thirst great. In some this fever will be

be more severe, in others more mild, and often most of the sick will be able to sit up through great part of the day, which cannot be urged as an argument against the infection, but only as a proof of its mildness.

If this fever be solely confined to the house, and the neighbourhood be entirely free, it is an additional proof of a *local* infection, as it shews the disease must proceed from a cause inherent in that house alone.

When spots are observed to rise above the surface of the skin, the fever by some may be supposed *Miliary*, and free from any danger of being communicated. But, in *contagious* fevers, those *raised* spots are very common. In the *malignant* fever before-mentioned, that prevailed among the *French* prisoners in *Winchester Castle*, and where the contagion was very mortal in the beginning of the year 1761, I remarked the spots were on most of the patients elevated, and of the *miliary* kind.

I have thus offered a few thoughts on a subject, which it is to be wished was more universally studied. The particles of contagion are of so subtle a nature, as seldom to fall under the inspection of our senses; hence in this, as in other abstruse subjects, there is a large field open for dissensions.

Men indeed of the greatest learning have frequently disagreed in their opinions concerning the real or possible existence of an infection from many distempers: of which the *yellow fever* in the *West Indies* furnishes a very striking instance.

Not long since, this fever became an object of consideration before the Right Honourable the Lords Commissioners of Trade and Plantations, where it was urged (among other reasons for not removing the seat of the government and justice in the island of *Jamaica*, from *Spanish-Town* to *Kingston*), that there was danger from *Greenwich* hospital, situated near *Kingston*, of an infection from the *yellow fever* being frequently communicated to that town. On this affair a physician was consulted who had long practised in that island, who gave it as his opinion, that, from the *yellow fever* in that island, there was *no* infection. This was not only the opinion of that gentleman in the court, but is the belief, as I am informed, of the best practitioners in that island; as also of Dr. *John Eliot*, a skilful physician in *London*, of Mr. *Nasmyth**, and many others, who

* See his letter relating to the fevers of *Jamaica*, in the *Essay on the Means of Preserving Seamen*, Chap. I. Sect. x.

have

have had opportunities of being well acquainted with the diseases of *Jamaica*.

On the other hand, our *American* colonies are under great apprehensions of the importation of the *yellow* fever, in goods and ships, from the *West-Indies*, by which they have often suffered. Dr. *Linnen*, in his account of the *yellow* fever in the *Edinburgh Medical Essays*, supposes it to be *infectious*; others have also been of the like opinion. A few years ago a gentleman dying at *Barbadoes* of a *yellow* fever, his wearing apparel and linen, packed up in a chest, were sent to his friends at *Philadelphia*; where, upon opening the chest the family was taken ill; and the cloaths being unluckily hung abroad to be aired, they presently diffused the contagion of the *yellow* fever over the whole town; by which the gentleman, who furnishes me with this relation, was an unhappy sufferer, and of which fever 200 persons died.

We can only reconcile the facts that may be produced on both sides of the question, in support of those opposite opinions, by supposing, that the *yellow* fever in the *West Indies* is sometimes of a mild nature, and altogether free from infection, while at other times it is more violent, and highly infectious.

Notwithstanding the difficulties that must always attend an inquiry into the nature and properties of infection, and the influence of various causes on its operations, yet there are, perhaps, but few subjects on which the vulgar and inexperienced so freely give a decisive judgment. But in no point ought we to be more cautious in admitting a decision, especially a negative one, than in this, which is often so highly interesting both to the public and private safety.

Many countries and cities, in all human probability, might have escaped the dreadful scourge of the pestilence, by taking the proper measures * on its first appearance; if, on such occasions the incredulity of a few had not generally been so great, as at its first breaking forth to deem it merely a fever void of infection. Their reasons were, because no marks of contagion were found on the dead bodies, because its progress was slow, because it raged at first chiefly among the poorer sort, and might be owing to poverty, to cor-

* Separating the sick from the suspected, though in health; shutting both of them separately up with their proper officers and the necessary attendants; and carefully tracing out the seeds of the infection, where lodged, that they may be effectually destroyed, by the application of fire and smoke, are the most probable means of stopping a plague, or any other mortal contagion.

rupted food, unwholesome drink, or to many other conjectural causes. That this proved their fatal mistake, is well known to such as are conversant with the histories of the different plagues in *Europe*. And the like arguments are frequently used against the existence of any infection.

The phænomena, even in the most manifest contagion, are often altogether unaccountable. Thus the *Small-pox* has been for some ages past, and continues still to be, the terror and destroyer of a great part of mankind. But from what origin, or how, was this infection first generated? Many opinions have been given, on this matter, equally incapable of proof or refutation. And the original causes of this, as well as of several other contagions, continue still among the hidden secrets of nature, notwithstanding the many plausible conjectures concerning them. The real existence of an infection can only be ascertained by its visible effects, many of which are also inexplicable.

Thus the *Europeans* have carried the *Small-pox* to almost all parts of the world, where their ships have opened a trade; though the seamen in those ships might not have been afflicted with it in that voyage. This venom has been conveyed, in

an old blanket, to nations of *Indians*; some of whom it has almost extirpated. It will lie concealed for a long time in cloaths, so as to be carried in them from *England* to the *Cape of Good Hope*, and even to *China*. Now, in most countries into which it hath been once introduced, it seldom fails to make its appearance at an interval of some years, or oftener; except in those places where the same precautions are used against it, as against the plague. By these precautions it has often been effectually prevented, for many years, from coming, both in several inland towns of *England*, and in many colonies of *British America*. Although there are the most convincing proofs, that this disease is neither hereditary nor innate, and the highest degree of probability, that it can be propagated in no other manner at present, than by an infection; yet, during the utmost exertion of its force, endeavours used to give it to some persons, by lying in the same apartment with the infected, and other methods of a free communication with them, do often prove ineffectual: and some of the constant attendants about the sick in this disease have never been infected.

What is still more extraordinary not only the small-pox and the plague, but
other

other contagions, which I have known to rage in ships and prisons, after exerting their utmost violence, will sometimes *abate* by degrees in malignity, and at length *stop*. Have they exhausted *themselves*, or the *subject*? That they do not always exhaust the *subject* is plain from facts, and our experience. Thus, although the infection of the small-pox was pent up entirely in the *Royal George* (as mentioned in Chap. I. Sect. iii.) among eight hundred and eighty men; yet this contagion disappeared altogether at sea, several months before the ship put into any harbour, after having destroyed four or five persons, and left near one hundred unattacked. It had unfortunately been introduced into that ship by a boy, who lodged in a house where the small-pox was.

The supposition, that contagion exhausts *itself*, may be perhaps admitted in some plagues; though at best it is an *hypothesis* attended with insuperable difficulties.

Further, the specific nature and qualities of contagions differ from each other, and are in many respects inscrutable. How far does each extend its proper sphere of activity? Who can explain why the small-pox will infect persons but once during their life; while the plague and other
in-

infections attack again and again? There are unquestionably certain limits prescribed to human researches, beyond which, tho' fancy may take its flight, and theory make wide excursions, all is conjecture, obscurity, or profound darkness.

CHAP.

C H A P. III*.

Of Infection.

Various symptoms proceeding from infection of the malignant sore-throat, its prevention. Remedies against the Plague. Bad symptoms in fevers.

Haslar Hospital, 4 Dec. 1763.

AN unwearied attention to the subject of fevers and infection, for three years, since the preceding chapters were originally drawn up, have abundantly confirmed their contents: facts of the most public nature still continue to enforce the truth of the doctrines contained in them.

Thus in the *Royal Sovereign*, a guardship at *Spithead*, there has been an infection for two months past; and, since the 23d of *October* last, ninety-seven of her people have been admitted into this hospital, of whom eighty-three were afflicted with the *Ship-fever*. Of those four are dead, and all the rest are recovered, except such as were lately admitted, none of whom are at present in

* In the former edition this was added as a Postscript to the other two chapters.

a dangerous condition. This fever hath been accompanied with no symptom that can be called *malignant*, unless a greenish or bloody discharge from the blistered parts, and that only in a few. With five persons the fever continued beyond the *seventh* day. The attack of it was generally very sudden, and, in some, with frightful dreams during sleep.

Although this fever always proceeded from the same infection, which was confined to that ship alone, yet after the disease had passed its first stage, accompanied with chills, sickness, head-ach, &c. the symptoms become so much diversified in different patients, that a physician, unexperienced in such matters, might be apt to judge some of them to labour under a *nervous* fever, others under a *Peripneumony*, or bastard *Pleurisy*. Some are *Costive*, others have a constant *Purging*. Symptoms, almost common to them all, are a low, quick pulse, a constant heat and thirst, and a perceptible alteration in the eyes. It is more than probable, that was any person, after having left this ship for some days, to be taken ill with this fever in a country-town, the true nature of his illness might not be suspected, and therefore the proper means of relief might unfortunately be neglected. Of *nine* nurses,
con-

constantly attending those patients, only one has been infected, who immediately recovered upon taking a vomit.

For some years past, neither in this hospital, nor in this part of *England*, have fevers, altogether *inflammatory*, been very frequent. Some practitioners give the name of the *bilious* fever to that which in these parts has mostly prevailed. Now and then the *malignant Sore-Throat* has made its appearance. Is not this last disease a plague, *sui generis*, imported, like some others, from the *Levant*, and which has now spread itself over different parts of *Europe*, and of the *North American colonies* *? Dr. *Tournefort*, in his voyage to the *Levant*, observed it above sixty years ago in the island of *Milo*: “Where (he says) “there then raged a terrible distemper, “not uncommon in the *Levant*; it carries off children in twice twenty-four “hours. It is a *Carbuncle* or *Plague-Sore* “in the throat, attended with a violent “fever. This disease, which may be “called the *Child’s-Plague*, is epidemical, “though it spares adult people. The best “way to check the progress of it, is to

* See Extract of a letter from *Cadwallader Colden*, esq. concerning the *throat distemper*. Medical observations and inquiries, by a society of physicians in *London*. Vol. i. p. 211.

“ vomit the child the moment he complains of a sore-throat, or that he is perceived to grow heavy-headed.” An excellent advice, which cannot be made too public, or too warmly inculcated.

In the only two cases, of a fair trial, which have occurred to me, a vomit, given on the first attack of a *malignant ulcerous sore throat* by infection, effectually removed the disease.

A captain of a man of war at *Gosport* was seized with this distemper, then his son, his sister-in-law who attended him, and lastly his daughter, all in the same family. One afternoon, when visiting these patients, I was told the servant maid in the house was also taken ill; her throat was already affected, she was feverish, and confined to bed. I immediately ordered her a vomit, which she took without delay; she sweated much in the night, by means of an *opiate* given afterwards, and next morning was in perfect health.

A similar instance occurred in another family, where a nurse was infected by attending a person in the same disease, and was immediately relieved of the sickness, fever, and beginning sore throat, by a vomit and plentiful sweat.

The celebrated *French* botanist and physician, in his first letter from *Constantinople*
to

to the count *de Pontchartrain*, relates, in a few words, what appears to be the best remedies, against the plague.—“ A vomit (says he) must precede other remedies, which is to be repeated, according to occasion, without delay, the moment the head is affected, or the least loathing is felt. If the smallest spot appears on the body, it must immediately be scarified, and an issue made with *lapis infernalis*, as soon as possible, in that part, where the strength of the poison chiefly discharges itself.”

I have little further to add, in respect to the symptoms common to such fevers, as are eminently contagious. The spots have been already described. The yellow colour of the skin, which is now and then observed, continues sometimes but twenty-four hours, often for three or four days. When the blistered parts are covered with a tough jelly, like leather, about an inch in thickness, and separable from the parts underneath, by means only of a gentle moisture, oozing out from below it, this is a proof of a malignant, and highly dangerous fever. After the separation of that detached skin, a smaller, tough jelly is apt to rise. If in the

the flesh, under those substances, there are observed *white* or *ruddy* specks, it is a favourable appearance; but if those specks appear of a *pale* or *dark* colour, all hopes of life are vanished. The *offensive smell*, peculiar to patients labouring under such fevers, continues with some after death. A *bleeding* from the nose sometimes happens in the beginning of the disease, and is, for the most part salutary, but we have seldom or never remarked it towards the close of life. A degree of *deafness* is most usual towards the end of the disease. The first observation I made on this symptom, was in a ward containing twenty patients labouring under a *malignant* fever, of whom six became deaf to a great degree; and of those, three recovered, and three died. But, upon a review of the cases of above four hundred patients who had this symptom, I find it cannot be reckoned to portend death; on the contrary, it hath been most usually remarked in recovering patients.

In those fevers the *pulse* seldom indicates a *general inflammatory* state of the blood, and there is very seldom any reason to suspect any *particular* inflammation. There seems likewise no great reason to suppose any great tendency to a *mortification*;

lation; at least in some thousand patients, labouring under such fevers, to whom *blisters* were applied, I never remarked a *mortification* to ensue, but from the neglect of a proper care and treatment of the blistered parts, as would have happened in any other disease.

C H A P. IV.

Of the Jail Distemper, with the means of putting a stop to it or any other contagious disease.

Haslar Hospital, 29th December, 1773.

S E C T. I.

Of the Jail Distemper.

Universality of the Jail Infection: mistaken concerning it; is not always attended with an highly malignant fever; is not always general in a prison; may be communicated by a person in health from tainted cloaths; does not reside in air.

WE shall here re-assume the subject of infection by a particular application of it to the jail distemper, a disease which in London has of late proved very alarming to the judges and court at the Old Bailey, from its frequency in Newgate, and in the other jails, and which even in the country has often caused the country assizes to be put off for some time. The influence of this infection is very extensive,

tensive, and my situation has afforded me great opportunities of knowing it.

The source of infection to our armies and fleets are undoubtedly the jails; we can often trace the importers of it directly from them; I have had many patients under my care at *Haslar* hospital, particularly deserters from the *Marines*, who were very ill of the distemper, and brought it immediately from thence: it is frequent in parish *Poor-houses*, an instance of which I formerly gave in the poor-house at *Gosport* *. I have seen it among the English felons in transport ships, in several Dutch ships carrying soldiers to *Batavia*, and during the late war among the French and Spanish prisoners, in their ships, in their prisons, and in their hospitals. In the year 1769 I had also an opportunity of viewing it on board the Russian fleet, then at Spithead.

In every situation, and among all these different nations, I found it to have the same appearance, to be precisely the *same* infection, as that described in the preceding chapters, which proves so often fatal in impressing men on the hasty equipment of a fleet; and by which the first

* In my Essay on the Diseases incidental to Europeans in Hot Climates, 2d edit. p. 181.

English fleet sent, last war to *America*, lost above two thousand men.

Very erroneous opinions are conceived of the nature of the distemper; I shall point out several of them, as mistakes in a matter of such importance to the health and preservation of many individuals, may be attended with fatal consequences.

The *first* I shall mention is an opinion that there can be no infection in a jail, unless where there is such an *highly malignant* fever as has been particularly described by several medical authors under the name of the *jail* or *hospital* fever. This may prove a very dangerous mistake. I may venture to say, that I have visited five thousand persons in fevers, which were evidently and indisputably produced by infection, yet I do not recollect above five hundred of that number who had the malignant symptoms there described. I do not advance that such a fever, or one equally malignant, is not sometimes to be met with in jails; I have already said I may have seen about five hundred such cases, and shall hereafter give an account of an infectious fever in the *French* fleet at *Brest*, which proved much more malignant and fatal. But these are uncommon cases, and many die of this infection with-

without having any *malignant* symptoms, as in the following case.

In November 1770, when a strict quarantine was enjoined to all ships coming from the *Baltic*, on account of the plague being in *Russia*, a report was spread that the plague had broke out at *Portsmouth*: I was employed by the government to superintend the affair, and daily to transmit a particular account of what passed. The alarm was occasioned by the *Yselmonde*, a Dutch ship from *Holland*, bound to *Batavia*, which anchored at *Spithead*, and was very sickly, burying a number of men every day; two *English* custom-house officers were sent on board, as usual, to prevent smuggling, and were both taken ill: one of them died in a few days after leaving the ship; the other, who also died, I attended during his illness; and six hours before he died, found him sitting up on the bed, dressed in his cloaths: his countenance was highly flushed, and he talked coherently, though there was a small degree of *stupor* on the brain; his symptoms were chiefly *peripneumonic*.

To prevent the infection from spreading further, the dead bodies were buried in the night, in a deep pit, together with all their cloaths, bedding, and household furniture. One or two of the attendants

were however taken ill, but they happily recovered.

There is indeed no particular symptom by which the jail distemper can be distinguished and characterised but its general symptoms, as frequently mentioned in the foregoing sheets, are a *low* fever, attended with a violent thirst and heat in the skin, often with *chills* at the beginning, and always with a disorder in the head, which may rise to a *delirium* or *stupor*. In common cases its symptoms resemble nearest what has been described by some authors under the name of the *nervous* fever; though frequently unattended with *malignant* symptoms, yet it is of a dangerous nature; it not only often proves fatal, but greatly injures the constitution of those who recover, and persons once attacked with it are subject to frequent relapses.

A second mistake is to suppose there can be no infection, unless the distemper be *universal* among the prisoners. But I would judge it a very general infection, when one *fourth* of the prisoners were taken ill of the distemper. Among two hundred prisoners in a jail, twenty or thirty are a great number to be seized, at least if we may judge from the effects of this infection in ships: I had lately under my care the men belonging to two infected

fects ships, the *Flora* and the *Pearl*, of which the following was the state.

The *Flora* frigate took on board three *Englishmen* out of a *Dutch* ship in the *Downs*, bound to *Batavia*; two of them were in perfect health, the other complained of an *Ague*, which returned every day: these men had been on board only a few days before the crew of the *Flora*, who had been remarkably healthy, began to be taken ill.

The ship soon after came to *Spithead*, and sent to the hospital thirteen patients in fevers, including two of the men taken from the *Dutch* ship, one of whom afterwards died, covered with *Petechiæ*.

This *Dutch* ship had 260 men on board, when it left *Holland*; of these it had buried twenty-two, and had fifty ill when the *English* men were taken out in the *Downs*.

The *Pearl*, another *English* frigate, just arrived from *Newfoundland*, perfectly healthy, at the same time took three *English* subjects from another *Dutch* ship lying at *Spithead*, also bound to *Batavia*; one of them was quite well, a second was recovered from a fever, the third looked sickly, but had no complaint.

In a week after these three men came into the *Pearl*, three of their messmates were taken ill of fevers, and several of the

ship's company began to complain. From the 7th of *December*, 1772, that is, ten days after the men had been taken from the *Dutch* ship, to the 12th of *January* following, we received sixteen patients in fevers from the *Pearl*, ten of whom were dangerously ill, two became yellow, and three were spotted. Both these frigates were soon afterwards paid off, and their men discharged, so that in neither of them could it be known how far the infection would have spread; but the progress of it, for above a month, in each ship, was very slow.

In the last war, among 4000 *French* or *Spanish* prisoners, we reckoned 5 or 600 a great number at one time to have the distemper of the prison; but the *small* number taken ill does not diminish the *danger* of the infection.

In *November* 1768, the *Guernsey* ship of war, of 50 guns, arrived at *Spithead* from *Newfoundland*, and sent twelve men to *Haslar* hospital; they had got a malignant fever, several had spots, one man had a swelling of the parotid gland, some were insensible and *comatose*, and lay in that state for several days covered with *Petechiæ*. It was remarkable, that so few men were infected out of the great number on board; although the infection was so virulent,
that

that a young gentleman slightly indisposed, who went from this ship to his sister's house at *Fareham*, gave this fever to his sister and to the maid servant, all three of whom, being the whole family, died of it. This infection was brought into the ship from *St. John's* in *Newfoundland*.

The third mistake, which I have frequently seen asserted in the public *news papers*, is, that a person cannot communicate a disease which he has not *got*, and therefore that there can be no infection from a felon or person *in health* brought from a prison into the open air, or into a court of judicature. But this is far from being the case, as the danger of an infection from a person really labouring under the jail distemper when kept perfectly clean, is found to be much less than from the contaminated *cloaths* and *rags* often carried about by a healthy person.

The *last* mistake which I shall mention is, that this infection resides in the *air*, and may be removed by ventilation, or a change of air.

Ventilators, some years since, when first introduced, it was thought, would prove an effectual remedy for, and preservative against, this infection in jails: great expectations were formed of their benefit, but several years experience must now have

have fully shewn, that ventilators will not remove infection from a jail. The mischief is indeed sometimes confined to a very narrow spot, as a bed, where ventilation cannot reach.

Thus I had lately under my care, two *Marines* in *Haslar* hospital, who had got a *petechial* fever by lying, one after another, in the same bed at *Gosport*, and, upon further enquiry, we found a third person had been infected with the same fever from the same cause. But ventilation, even in the purest air, and where it may be supposed to have its full effect, yields no perfect security against infection.

In the beginning of the last war, when the *North American* fleet arrived at *Spit-head*, with an infectious fever in several ships, three masters of a boat, employed to bring the sick on shore to the hospital, were successively taken ill of the fever, though two of them had used the precaution of not going on board any ship, and though the ventilation in an open boat at sea, in which place only they were exposed to the infection, was as perfect as could any where be obtained on shore.

S E C T. II.

Of the Jail Distemper.

Origin of the Jail Infection unknown ; its source ; is diffused by air as a vehicle ; its properties in common with the plague and small-pox ; small distance to which its influence extends ; its self-extinction ; method of destroying it in infected places and substances.

THE origin of the jail infection is a point at present entirely unknown. No person has given us the least satisfactory account how, or where, it is generated. It does not seem to originate in air, and there are many prisons abounding with filth and impurities, perfectly free from it.

In ships also an infection is generally imported from the land, and many, that have been long in a very dirty condition at sea, bring their men quite healthy into the harbours. Indeed I have always observed, that the most healthy ships were such as arrived from a long foreign voyage, the scurvy being the chief, and almost the only complaint among them : whereas, ships of war, especially when fitted out in
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the *Thames*, even in times of peace, very often received this infection from *London*.

The clearest idea we can conceive of the manner in which this infection is *communicated*, is to suppose there is in all infected places, adhering to certain substances, an envenomed *nidus*, or source of effluvia, corpuscles, or of whatsoever infection may be supposed to consist; and that the *air*, according as it is more or less confined, becomes more or less strongly impregnated with them. In this respect, the jail distemper, the plague, and small-pox are similar; though the air be the *vehicle* of the infection, by which they are severally communicated, yet none of these infections can be said properly to *reside* in air, but are occasionally sent into it, from substances in which they reside; such becoming always more highly infectious in a close confined place: by confinement in infected cloaths, the infection is *multiplied*, and acts with far greater virulence than when immediately transmitted from the *naked* body. Let us view, in proof of this, the different conditions of ships loaded with men and women, where the passengers are *covered* with tainted rags, and where they are almost entirely *naked*. An example of the former we have in the great mortality from the jail distemper,
usual

usual in ships carrying *Felons* to *America*, a circumstance universally known, and from whence our colonies have frequently suffered by infection: also in the *Dutch*, who are said to send annually 2000 soldiers to *Batavia*, and to lose three fourths of them by the ship fever before they arrive.

To these let us oppose the condition of the poor *Negroes*, who, in amazing numbers, are yearly shipped from *Guinea* to all the *European* settlements in *America*. The *Guinea* ships frequently carry double, or triple the number of either our transport, or the *Dutch East-India* ships, and the poor wretches are crowded together, below the deck, as close as they possibly can lie, with only a small separation between the men and women; every night they are shut up under close hatches, in a sultry climate, barred down with iron to prevent an insurrection. They have no bed to lie upon, and scarce any cloaths to cover them; the children, both boys and girls, until a certain age, go quite naked, and even the grown negroes have, for the most part, only a wrapper about their middle. They thus wear nothing capable of *im-bibing* or *retaining* infection; and, though some have been suffocated by the close confinement, or foul air, though they are
sub-

subject to the flux, and suffer from a change of climate, yet an infection is scarce known among them, or, if an accidental fever, occurring from the change of climate, should become infectious, it is generally much more mild than in the opposite situation, where polluted rags afford it a prompt * receptacle, and prove a con-

* A whole Indian Nation in *Nova Scotia* was not long since almost entirely destroyed by some infected blankets and cloaths. In the year 1746, while the *French* squadron, under the command of the *Duc d'Anville*, passed the summer at *Chebueto*, now *Hallifax*, an infectious fever prevailed among them, and cut off a great number of their men. On the return of the squadron to *Europe*, several blankets and old cloaths, which had been used in their tents and hospitals, were unfortunately left behind. These fatal receptacles of disease were soon after eagerly picked up by a party of *Mimack* Indians, who accidentally came to visit the place, and who cloathed themselves with some of them; others they carried home, and distributed among their tribe. The unhappy consequence of which was the almost total extinction of the *Mimack* nation; scarce any of them survived. The *English*, upon traversing the country next summer from *Anapolis Royal*, were surprised with finding the dead bodies and skeletons of whole families of that nation lying unburied in their huts, until the neutrals, who also inhabited that country, and the neighbouring Indians informed them, that the *Mimacks* had been cut off by the *French* blankets. In several of their huts these blankets were found, where not one of the family remained.

This account was given me by a gentleman of veracity, who, from being upon the spot, had an opportunity of knowing all the circumstances.

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stant source of fresh infection. In several other respects also, besides that of being conveyed by rags and tainted substances, the infection of the jail distemper agrees with that of the plague; in common with it, this infection extends to no great distance from its source, and is often extinguished without any evident cause.

First. This infection *extends* itself at no great distance; the houses in the neighbourhood of an infected prison, are in no danger of infection from it, provided all communication be cut off.

In the open free air, this infection does not appear to diffuse itself above fifty or sixty feet from its *Nidus*; though even at that distance, a person might run some risque from being exposed to a current of air highly impregnated with the contagion which issued immediately from a door or window, where it had been long pent up.

Secondly. This infection, after every method used to destroy it has proved ineffectual, will often of itself gradually *abate*, and at length entirely *vanish*; this circumstance I often observed in our prisons during the last war, where, after committing great ravages among the French prisoners, the infection often stopped of a sudden; and they were sometimes so entirely free from it, that in the month of

September, 1762, when I was employed by the government to muster the prisoners of war in the castles of *Portchester* and *Winchester*, which in the preceding year had suffered much by the jail distemper, I did not find one person labouring under that distemper among 7000 prisoners, many of whom had been confined for several years. But, as this infection often proves highly destructive before the period of self-extinction, it is a satisfaction to know, that in whatever substance, chamber, or prison it is lodged, it may at any time be effectually *destroyed* by the force of *fire*. Here two things present themselves worthy of attention.

1. That a *great* heat, like that of an oven, such as would prove destructive to all animal life, *effectually* destroys this infection in all substances which can be for some time exposed to it.

2. That an *inferior* degree of heat, in which a man can breathe, will often *fail* of destroying it.

Hence the infection may *with certainty* be destroyed in any ship, prison, or situation where the *people* can be *removed*, so that fires may be lighted, and the smoak confined with safety. But in prisons, ships, or places, where the people cannot be removed, and consequently a *sufficient*

cient degree of heat cannot be raised, the application of fire and smoke to remove infection, may prove *ineffectual*. I am confirmed in this assertion by repeated instances of infection in ships both at sea, and when lying at Spithead, where every method failed of putting a stop to it as long as the men remained on board. A certain method therefore of destroying infection, in places from whence persons cannot be removed, is a *Desideratum* not yet obtained in physic. I have proposed and tried many things for this purpose without success. However, there have been instances of large fires made in ships proving highly serviceable on such occasions, both at sea and in harbour, even while the men continued on board.

In March last, when a *Rendezvous* was opened at London for entering seamen for the guardships, one *Callaghan*, a ragged dirty fellow, was sent to *Portsmouth*, and entered on board the *Terrible*, a ship of 74 guns: soon afterwards, several men in that ship were taken ill, and at length *Callaghan* himself. All of them were sent to the hospital, and perceiving, upon examining them, that they had got an infectious fever. I immediately confined them in a ward separate from the other patients. Captain *Arbuthnot*, an officer not less distinguished

tinguished by his naval abilities, than by his care for the health of the men, commanded the *Terrible*, and having formerly experienced the dreadful consequences of infection in ships, exerted his utmost endeavours on the present occasion to trace its source; until at length he discovered the very man who had brought it on board; being then in *Portsmouth* harbour, he *cleared* his ship, ordered all the bedding to be taken out, and washed every hammock thoroughly in the sea; spread out every article of bedding in the highest parts of the ship, where it was most exposed to the wind, and could least affect the men below, and destroyed all spoiled and decayed articles. The ship being cleared, large fires were lighted in the *Hold*, and on all the decks below, the bedding was dried and smoaked, and every part of the ship *between Decks* was washed with boiling vinegar; by which means an entire stop was put to the infection.

At the hospital we had received twenty infected patients from that ship. They complained at first of violent pains in their limbs and a cough, but in a few days became, at times, delirious; and seven of them were covered with *Petechiæ*. One man only died, but the shock of this infection

Remarkable Instances of Infection. 323

fection was so violent on the constitution, that several did not perfectly recover their senses for twelve or fourteen days after the fever had entirely left them.

S E C T. III.

Remarkable Instances of Infection.

General influence of the Jail Distemper: its similarity to the epidemic, purple, and scarlet fevers: frequent instances of it in the French fleet: a dreadful infection at Brest.

THE influence of the jail infection is much more extensive than generally supposed: of a similar nature is the disease we frequently read of in the public newspapers, under the names of *scarlet*, *purple*, and *spotted* fevers, which often depopulate cities, and sometimes even whole countries. The countenance being flushed with a *scarlet*, or deep *purple*, especially at the approach of death, and the spots appearing sometimes of the same colour, which are looked upon as *peculiar* signs of malignity in such epidemic fevers, I have also frequently seen in the jail distemper.

It was this contagion which destroyed two-thirds of the men in the *Duc d'Anville's* fleet at *Chebucto*, now *Hallifax*, in

324 *Remarkable Instances of Infection.*

the year 1746 : the complete destruction of which was afterwards accomplished by the scurvy.

It was this contagion which ravaged the marquis *D'Antin's* squadron in 1741, the count *de Roquesfeuil's* in 1744, and the *Toulon* squadron in 1747, which last brought the infection into *Rochefort*. But a more recent instance of it occurred at *Brest*, in the year 1757, when the fleet commanded by *Monsieur Dubois de la Mothe*, arrived there from *Louisburgh*. The particulars are worth relating, as they afford a striking instance how from a small spark of contagion (if I may be allowed the expression) brought from *Rochefort*, a devouring plague was kindled, which not only totally disabled a large fleet, but proved fatal to many thousands, in the town and neighbourhood of *Brest* *.

Before *La Mothe's* fleet sailed to *Louisburgh*, they were joined at *Brest* by two ships of the line, the *Glorieux* and *Duc de Bourgoyne*, which having taken on board some men from the hospital at *Rochefort*; were very sickly : the sickness afterwards encreased in them to such a height, that even during their short stay at *Brest*, they

* See a particular account of this fever, with several curious observations and conjectures upon it, by Dr. *Poissonnier*. *Traité de Maladies des Gens de Mer*.

were

were obliged to send 400 of their sick on shore.

On the 3d of May, 1757, the fleet sailed from *Brest*, and arrived at *Louisbourg* on the 28th of June. During the passage, these two ships lost many of their men, and the sickness daily increased, while the rest of the fleet continued tolerably healthy, even for some time after their arrival. At length, however, the infection communicated itself to all the other ships in the fleet, not only from the mutual intercourse of the seamen, but more immediately from the *tent-hospitals* of the infected ships being placed too near the other tents. During their stay at *Louisbourg*, the fever became general, and was attended with a considerable mortality.

On the 20th of October the fleet sailed from *Louisbourg*, after having buried a number of their men, and took on board with them a thousand of their sick, who were so far recovered as to be able to embark, leaving 400 more supposed to be in an irrecoverable and dying state. But on going to sea, the contagion acquired new vigour; in less than six days most of the thousand convalescents were dead, many others were taken ill, and in the course of a few weeks the squadron was entirely

disabled ; so that, on the 22d of November, when they arrived at *Brest*, the few seamen who remained in health were scarce sufficient to navigate the ships, much less to give the necessary assistance to the sick. Four thousand men were ill, the holds, decks, and every part of the ships were crowded with the sick ; to add also to their misfortunes, necessaries of every kind were wanting, and all the surgeons and almoners either sick or dead. Their continuance but a few days longer at sea would, in all probability, have yielded them a sacrifice to a few *English* privateers, or rendered them a prey to the winds and seas. In this deplorable condition the *French* fleet, which had that year saved *Louisbourg*, arrived at *Brest*, totally disabled. On their arrival, seamen were immediately sent from other ships to bring them to an anchor, and surgeons from the marine hospital to assist the sick. But unfortunately the *Bizarre* and *Celebre*, two ships of war, had lately arrived from *Quebec* with a similar fever, and had sent, a few days before, about a thousand men to the hospital. Four thousand additional, unexpected sick were now to be landed, for whom no accommodations or necessaries were prepared. At first, during the general confusion, they were

were for a few days promiscuously crowded together into every place they could gain admission, where death hourly thinned their numbers. But at length fifteen hospitals were fitted up for their reception, and physicians and surgeons voluntarily came from all parts to their assistance, besides those immediately sent by the court from *Paris*. Even that number of hospitals, however, was scarce sufficient to contain the sick, they were yet too crowded, and the mortality from thence prodigious. The contagion was for a short time entirely concentrated within the hospitals, and the mortality confined to those landed from the fleet, but it soon spread to the attendants. Five physicians, one hundred and fifty surgeons, and two hundred almoners and nurses fell victims to its rage, with many slaves, who, by a promise of their liberty, were engaged to assist the sick.

From the attendants it passed to the lower class of people in the town, among whom it quickly diffused itself. The devastation then became general, whole houses were filled with the dying and the dead.

An ordinance was published from the pulpits, and in all quarters of the city, proclaiming, that every sick person might

328 *Remarkable Instances of Infection.*

have a physician *gratis* to attend him, and upon his certificate would be supplied at the public expence, with all necessaries, food, and medicine. But it was soon found, that in many houses there was not one left in health to call a physician, and in several, the dead bodies had remained on the same account many days without burial.

This produced a second ordinance, enjoining the priests to examine every house, and a physician and commissary to attend wherever they found any sick.

The symptoms of the fever were the same as we have already given in the description of the jail distemper. On dissection, the *Brain* of those who died was found perfectly sound, though during their sickness the head had seemed always greatly affected; in two cases only, out of twenty which were inspected, the blood-vessels of it appeared a little enlarged. The *Lungs* were generally found gorged with blood, and seemed to have a gangrenous disposition. The *Abdomen* more immediately suffered by the disease, particularly the *Liver*, *Stomach*, and *Intestines*; in the *Intestines* there was often found a green offensive liquor, sometimes worms.

The disease afterwards began to appear in some parts of the neighbouring provinces,

yinces, being carried thither by people who fled from *Brest*. But the alarm there was short, as in *March* the fever began to abate, and in *April* it intirely ceased, having carried off, in less than five months, upwards of ten thousand people in the hospitals alone, besides a great number who died in the city of *Brest*.

This great mortality may easily be accounted for, if we consider the crowded state of their hospitals. The number of sick, as *Dr. Poissonnier* observes, was so great, that it was impossible to keep them clean, and their stench was so intolerable, that it might be compared to that of a hot bagnio full of corrupted bodies: the morbid emanations from the dead, also, hourly encreased the strength of the contagion. No person in health could enter the hospitals, without being immediately seized with a head-ach; and indisposition of every kind quickly became fatal. The slightest infection, which in a pure air would have proved of no consequence, in an air so highly contaminated soon acquired the utmost degree of virulence; and those who survived the first attack of the fever, were sure to suffer a relapse. Confinement in such a place was almost certain death, and such as had no fever when sent thither, soon served, equally with the infected,

fect, as additional fuel to the devouring flame.

S E C T. IV.

Of Prisons.

Means to prevent infection, applied to prisons, to prevent its being generated; free air necessary, proper arrangement of doors and windows, wind stoves, wind-sail; plenty of water necessary; no furniture to be kept which can imbibe infection: to prevent its being carried into prisons, a large oven, a bathing-room necessary: to remove it from prisons; prisoners to be carried to another jail; fumigations. When prisoners cannot be carried out, separation to be made between the healthy and sick. Prisoners occasionally to be moved, and the evacuated cells fumigated, the infected cloaths to be purified by fire, by fumigations; degree of heat necessary to destroy infection,

HAVING endeavoured to explain in the preceding sections the general nature and properties of infection, and having shewn the fatal consequence of inattention to a subject of such importance, we shall now enter upon the methods of preventing an infection from being generated, of check-

checking it in its *infancy*, and of suppressing it, where it universally occurs.

As *prisons* are the chief source of contagion, these first claim our attention; with respect to them I will, in the first place, endeavour to point out the principal objects of attention in their construction, so as to prevent an infection from being *generated*. The same will be applicable to any other house, where a number of people are crowded and confined together.

A *free air* is the first article of importance. This, next to the *situation* of the house, will most depend on a proper *arrangement* of the doors and windows. A prison should have windows in every direction, that it may embrace the advantage of the wind from whatsoever quarter it blows. A free circulation may indeed at all times be procured, by opening a small chink at the lower part of one window for the admission of fresh air, and at the upper part of another for the exit of the lighter and fouler air. If the window opened face the quarter from whence the wind blows, and the foul air is permitted to escape by the top of another window in an opposite direction, the circulation will be still more perfect. So effectual is this method, even in calm weather, that,
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if the room be otherwise close, the flame of a candle applied to the lower chink of the window, will be blown inwards towards the room by a current of cool air, and, applying the candle to the upper part even of the same window, the flame will be carried outwards by a stream of heated air. To promote also the general circulation of air, every apartment should have a *hole* cut in the *lower* part of the door for its admission.

Those cells which cannot be ventilated by windows, should be furnished with *wind stoves* and narrow chimneys. Fires lighted in such places, will cause a very considerable circulation of air; while, at the same time, the heat contributes to remove the dampness of their situation.

But the most effectual means of procuring a general circulation of air throughout the whole prison, is by what is called a *wind-sail*; a contrivance, which for its simplicity, ease, and effect, far exceeds any method of ventilation yet discovered. It consists of a sail fixed on the top of the house, the lower end of which is contracted like a funnel, and supported in that shape by small hoops; to this a large canvas pipe is added, whereby the air may be conveyed to the inmost recesses of the prison. It should be spread even in the calmest

calmest weather, as very slight winds will be found to have a sensible effect on it; in windy weather it may be contracted, and in stormy, entirely removed. Besides which, it requires no further attendance than to place it every morning in a proper direction to the wind, a circumstance which the vane on the top of the prison will always point out; exactness is by no means requisite, as slight variations of wind scarce affect it. Its effect, when there is a little wind, is prodigious, it pours down such a current of air, as will be felt through every part of the prison; and to promote this, the end of the canvas pipe should be carried into the lower apartments, and the windows of the upper be opened.

I am sensible the inclemency of the weather may be urged as an argument against this practice. During severe frosts and raw damp weather, especially at night, it may therefore be sometimes proper to diminish the ventilation, but it should never be entirely suppressed. It is not the common degrees of heat or cold, or the long continuance of either, which affect health, but the frequent and sudden changes from one extreme to the other; and the prisoners will soon become so habituated to a free air, as even to perceive

the changes of weather less by thus regulating the circulation of it, than when accustomed to close confined situations. The ventilation, however *regulated* according to the weather, should be *constant*, scarce any weather can be pleaded as a sufficient excuse for shutting all the inlets of air, as it will afterwards render the prisoners more susceptible of cold, when again exposed to it. We often find, that if in calm weather a company enter a room, where part of a window is open, unobserved, or covered perhaps with a curtain, they will not perceive the least inconvenience from it; but, if it be opened after the company have been some time in the room, the effects of the cold air will be immediate and sensible. In our *Small-Pox* and *Fever* wards in the hospital, where windows are kept open both night and day, even during the severest frosts of winter, the patients seldom complain of cold, provided they have warm bedding and good fires; but on my going into the *Recovery* wards, where the patients cannot be prevailed upon to keep a window constantly open, no sooner are the doors and windows ordered to be opened for the benefit of a little fresh air, than the men are excessively chilled, and complain of the cold,

cold, even in moderate weather, being intolerable.

It may be further necessary to observe, that to prevent any inconvenience from a *Draught* of air, every aperture for admitting it should be *large*, as the more a current of air is confined, the more rapid it becomes; through small crevices it always rushes with impetuosity, whereas, through larger openings, it generally comes in gently and almost imperceptibly. This may be illustrated by a familiar instance of what daily occurs in one's study, when there is no fire in it, and a good deal of wind abroad; if a chimney-board be applied, which is not altogether tight, the air rushes through the crevices in many small streams, so as to render the room cold and disagreeable; but when the chimney-board is removed, and the opening enlarged, so that the external air mixes easily with that in the room, it does not create the least inconvenience.

The next object is *plenty of water*: the greatest attention should be given to the construction of what the French call *les parties honteuses*. The advantage of a river as the *Thames*, or even of the sea flowing. Under these, to carry off all filth and nuisances, will be found to conduce more

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to their cleanliness, than the strictest care could effect in a more inland situation.

Cleanliness should also be regarded in every article, and nothing be retained in a jail which can harbour *infection*. The walls should only be *plaistered*, and there should be little or no *furniture*. The *bedstead* should be made of iron, and have no *curtains*; and the *straw* on which those lie who cannot afford, or are not allowed, a clean bed, should be daily shifted and renewed. These means promise an almost certain security against the *generation* of sickness in a jail.

Our attention shall next be directed towards preventing an infection from being *carried into* a jail; for this purpose every prison should be provided with a large *oven*; as the effectual means of preventing the importation of a disease would be to *strip* every prisoner of his rags immediately on his admission, and to send his *cloaths* to be baked in an oven. This will answer two good purposes, in both removing *infection*, and destroying all sorts of *vermin*. The only precaution here requisite, is to sweep out all ashes clean from the bottom of the oven, and to spread the cloaths on a few sticks, to prevent their being singed or burnt.

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At the same time, all prisons should have a *bathing room*, furnished with bathing tubs; and proper conveniences for *washing* and *cleaning* any filthy persons who may be admitted.

Lastly, we shall proceed to deliver the most proper means of *removing* this infection, when it has *already* made its appearance in the jail. The chief obstacle that occurs in this case, arises from the difficulty of emptying the prison, so as to admit of the necessary fumigations.

When the prisoners *can* be removed, the infection will most effectually be extinguished by their *removal* to another prison, and after thoroughly cleaning the infected out, to *fumigate* it with the smoke of *tobacco*. All *smuggled* tobacco, that is seized, is directed by law to be burnt, and instead of burning it, as at present, in the open air, a grant might be obtained from government of a constant supply of *condemned* tobacco from the Custom-House to be burnt in the *Savoy*, *Newgate*, and other prisons, under the inspection of the proper revenue officers. Large fires of tobacco, when *closely* confined, with proper conduct, would totally destroy the infection, but it does not appear that burning of tobacco in the *open* yards or courts of prisons, would be of

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the least benefit; it should rather be burnt in the cells, and most damp unventilated places.

When the prisoners *cannot* be removed from an infected jail, a separate apartment, under the name of an *Infirmary*, should be allotted for the sick. A proper *division* should there be made of such as have fevers, of such as are on recovery, and of such as labour under different diseases. During an infection, in a crowded prison, among two or three hundred prisoners, it will sometimes be surprising to find, not only how *few* really labour under the jail distemper, or have the fever in a high degree, but also how *soon* their number will be diminished by cleanliness, and a regular separation of the recovering, and sick. I have seen, that, out of seven hundred infected patients, the number of those who were really *confined to bed* after eight or ten days, by properly separating and classing them, did not amount to thirty or forty.

In the infirmary, the *windows* should be kept open night and day; in the winter, fires should be allowed, and proper coverings, together with clean *dressers*, kept, if possible, for the sole use of the sick; *clean* dry beds, or straw, would also in a particular manner contribute to their recovery.

covery. All the sick being thus moved into *one* place, the prison should be thoroughly cleaned out, the *walls* new plastered, the *floors* and *bedsteads* washed with boiling vinegar, and repeated fires of tobacco made in all the apartments; the prisoners being *occasionally* moved, while the fire is closely shut up in their own apartments. At such a time there should be a *smoke-house* adjoining to each prison, built entirely of brick, without any window, or any other inlet of air but the door; having iron hooks on the sides of the walls for suspending of cloaths. As, during a vigorous infection, an oven may not be sufficient to purify all the infected rags or cloaths sent from the infirmary, they should be here spread upon the iron hooks, and fumigated for some hours with the smoke of *Brimstone* sprinkled on *Charcoal* fires, which must be previously well lighted in the open air.

I am perfectly convinced, from long experience, that no infection whatever can resist the force of a *close confined* fire, or the *heat* of an *oven*; a degree of heat, even less than that which bakes bread, is sufficient to extinguish it, and will, at the same time, neither injure substances of linen or wollen. Strong fumigations with *Charcoal* and *Sulphur*, long and closely

confined, will also destroy the infection. wherever it is lodged, if the infected substances be well opened and exposed to them.

By thus cutting off all *communication* between the sick and the healthy, *fumi-gating* the apartments and cells with tobacco, and *purifying* all tainted cloaths, either by exposing them to the *heat* of an oven, or the *steams* of brimstone and charcoal, the most violent infection will effectually be subdued; an object of the utmost consequence in all crowded jails, and which humanity must recommend to the attention of those in direction over them.

SECT.

S E C T. V.

Of Courts of Judicature.

Means of checking infection in its infancy, applied to courts of judicature: to prevent infection being carried into court, clean dresses proposed for prisoners at the bar, a canvas frock insufficient, court rooms to be well aired: precautions when prisoners are introduced in their infected cloaths: personal preservatives against infection; different modes by which infection can be received; means of obviating it when received into the body: recapitulation of necessities for prisons and courts to avoid infection.

THE method of checking an infection in its infancy, and of preventing its being further communicated, next demands our attention. This may be looked upon as an intermediate stage between the first rise of infection, and its being universally diffused. We shall give it, by way of example, as more immediately applied to the preservation of the judges, and those who attend courts of judicature, into which prisoners may be brought from infected jails, though it is equally applicable to

all persons *exposed* to infection. It thus regards, first, the method of preventing an infection from being *brought* by prisoners into court: secondly, *personal* preservatives against infection: and thirdly, means of obviating an infection when first *received* into the body.

1. During a prevailing infection in the jail, the security of the judges, and attendants on the court, will, in a great measure depend upon every prisoner, before his admission at the bar, being stript, well *washed* and *cleaned*, and afterwards having a complete suit of *clean* cloaths put upon him. A *canvas* frock, as of late wore by the prisoners over their infected cloaths at the bar of the *Old Baily*, serves only to cover the tainted rags, and affords no security against the infection. All prisoners, on being brought into court from any suspected jail, should be allowed clean *washing* dresses, consisting of waistcoat and breeches, a shirt, and a pair of stockings, they may be either made of *linen* or *woollen*, the last of which, indeed, may be thought improper, as retaining infection, but for this reason ought perhaps to be used, as it is better that an infected person should wear an *absorbent*, than a *repellent* of his own effluvia. The cloaths should always be washed with *soap* and
water

water every time they are used, and the linen shirt be afterwards dipt in *vinegar* and well dried; they should also occasionally be *fumigated* in the smoke-house. This would prove the most effectual method of preventing any disease from being communicated, as a person thus dressed carries about with him no infection; even upon a supposition the prisoner *has* really the jail distemper, he will thus be less apt to communicate it in the open air of the court with *clean* cloaths, than a person who, *in health*, brings *infected* cloaths to the bar, though covered with canvas.

If the prisoner at the time really *labours* under the jail fever, (as I am persuaded many in that disease are able to walk about and take their trial,) his whole body should be washed in warm water mixed with a little *vinegar*, and the suit of clean linen which he puts on may be sprinkled with *vinegar*, his mouth and nostrils being rubbed with a little *camphire* dissolved in oil. By these means the prisoner will be in a manner divested of infection, and neither from his appearance nor smell, unless, perhaps, from the scent of the *vinegar*, can give the least alarm to the court, a thing which ought, on all such occasions, cautiously to be avoided.

Every *court-room* should also be constantly kept well aired, perfectly dry, and free from damp, by the occasional burning of *tobacco* or *wood* fires.

When these precautions cannot be taken, and a person is of necessity brought with his *infected* rags into court, or before a justice of peace, he should be kept in a *free* or almost open air, and in a situation where no draught of air can convey the infection from him to the judge: thus, if the prisoner be examined in a room, it will be proper to open a window, and the judge with his attendants to be placed on one side of the open window, while the prisoner stands by himself on the opposite side, so that a current of fresh air may constantly pass between them.

2. Relative to *personal preservatives*, it is to be considered that infection can only be received by immediate *contact*, that is by touching the infected person or substance, or by means of the *air* as a *vehicle*. The first way may in general be effectually prevented, by avoiding a too near approach to the prisoner; and even the second way of receiving an infection may be guarded against, by properly defending the two principal *inlets*, by which the air, its vehicle, is admitted into the body: these are the *mouth* and *nostrils*, to defend which,

which, I have used with success for many years, a roll or *dossil* of lint, dipt in * *camphorated* vinegar, put up each nostril, so small as not to be perceptible even to a bystander. Such rolls, about the size and form of a small pea, may be kept occasionally in a box for this purpose. Persons who have an aversion to putting such dossils up their nose, or to whom the smell of the camphire may prove disagreeable, should mix the *camphorated* vinegar with *spirit* of *rosemary*, or, as it is called, *Hungary* water, when it will prove an elegant and agreeable perfume. A little of this sprinkled on a handkerchief, and held at the nose, will answer all the intention of the dossils, while, at the same time, its grateful scent will relieve from the nauseous idea of constantly making use of a medicine.

The *mouth* may also be washed with this before going into court, and small pieces of *lemon-peel*, dried in the sun, or by a gentle fire, be chewed during the

* The *camphorated* vinegar is made by rubbing in a mortar a quarter of an ounce of *camphire*, moistened with a little *spirit* of *wine*, with two ounces of fine *sugar*, and when reduced to powder adding gradually to it a quart of hot *vinegar*. If necessary, the liquor, when cold, may be strained. The camphire thus takes off the sharpness of the vinegar, so that it does not irritate the nostrils.

whole

whole stay in it; this has an agreeable flavor, procures a discharge of *saliva*, and I am inclined to believe, impregnates the saliva with particles that resist the infectious *effluvia*.

Many place confidence in a quill, filled with *quicksilver*, and corked at each end, carried in a pocket near the groin. It is so penetrating, that I have known it affect gold in the other pockets. Such as have faith in amulets, may make use of this, all that I can say in its recommendation is, that several surgeons in our hospitals, who had recourse to it, imagined it attended with success.

3. If, for want of proper precautions, a person be seized with *chills* or *sickness*, after examining a prisoner, visiting a prison, or being in a crowded court of judicature, where prisoners suspected of infection have been tried, he should immediately take a *vomit*, a remedy which seldom, or never, fails to prevent the future mischief; *principiis obsta*, is an axiom no where more applicable than on the present occasion. Should this remedy be administered too late, and the fever still continue, the proper method of treating it may be seen in the foregoing chapters.

Jails

Jails being the frequent seminaries of contagion, not only to courts of justice and great cities, such as *London*, but also to our fleets and armies, their state, and the condition in which they are kept, becomes a national and important concern : I shall therefore give a short *recapitulation* of the *necessaries* recommended to every prison for perfectly *removing* infection, that an estimate may more easily be made of their small expence :

1. A *wind-sail* fixed on the top of the house, to ventilate the prison.

2. A *bathing room*, with *bathing tubs*, and a *copper* for heating the water, to which a small quantity of *vinegar* is occasionally to be added. Here all unclean persons, when first received into prison, and before going into court, should be washed and cleaned.

3. An *oven* for destroying vermin, and removing infection from tainted rags and apparel.

4. A *smoak house* for purifying larger quantities of infected cloaths and bedding than the oven can receive.

5. Twenty or thirty complete suits of *washing dresses*, in which the prisoners are to be cloathed when in court, or under examination ; as also several *dresses* for the infirmary, appropriated solely to the use

348. *Of Courts of Judicature.*

use of the sick. These dresses, with care, may be made to last for several years.

The expence of *fuel* for the oven, and of *vinegar, charcoal, and brimstone* for the smoke house, &c. is too trifling to be mentioned. Tobacco also, that useful article for purifying the infected apartments, would cost nothing, if the plan proposed were admitted,

SECT.

S E C T. VI.

Method of stopping Contagious Diseases.

Method of stopping an infection when universally diffused; danger of indiscriminately shutting up whole families; the healthy to be shut up; the dispersed sick to be collected into one place; arrangement of infected patients; opinion of infected patients when collected together being prejudicial to each other refuted; plan of regulations drawn up for suppressing an infection in a Russian fleet, when at Spithead: difficulty of distinguishing infectious fevers: benefit of pure air in fevers.

I shall, lastly, offer some general directions for putting a stop to an infection when *universally* diffused. As we have already endeavoured to prove infection does not *reside* in air, the principal objects of attention are, *first*, to cut off all communication between the healthy and sick; and, *secondly*, to collect the dispersed sick, so as to confine the infection to a narrow spot, where, by proper arrangements, it may be totally extinguished.

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The method of *indiscriminately* shutting up whole families in their houses, wherever a *sick* person is found, as is commonly practised in Europe during the rage of the plague, or any general infection, is attended with the most dangerous consequences. Sollicitude at first to conceal the progress of the disease, and continual endeavours afterwards to fly from its attack, are the immediate consequences: the confined look upon themselves as thus doomed to certain death, and neither the strictest vigilance, nor severest punishments, can prevent their escape; which still further diffuses the infection. The very *reverse* method should on such occasions be put in practice, whereby self-interest may be led to strengthen every regulation that is enjoined. On the first alarm, families that are *in health* should immediately shut themselves up, and stop all communication with the infected; after which, an entire *separation* should be made between those who remain in health in the infected houses, and those who are sick, the dispersed sick should be carefully *collected* into one place, and the houses be *purified* on their removal; as others are taken ill, they should also be immediately put with the sick, and, in a short time, the

the infection will be wholly confined to one spot.

When the sick are *collected* together, they should be *arranged* into two classes, into such as are only *slightly* infected, and into such as have a *constant* fever. In all infections this distinction may be observed: the plague itself attacks with different degrees of violence, and often appears only in the form of an intermitting fever*. The jail distemper also sometimes attacks in a slight, sometimes in a more severe degree; and it seldom happens, that one *third* of the patients infected, are so ill as to be confined the whole day to bed, especially after having been blistered. By making therefore a perfect separation between these two classes of patients, due attention can more easily be paid to cases which most require it, and the *sphere* of contagion will be greatly contracted; since long observation has led me to believe, that patients with a *slight* infection, when kept perfectly clean, and in well-aired apartments, do not communicate the disease. Constantly as the patients recover, *new* arrangements should also be made, and the convalescents be

* See Dr. *Russel* on the Diseases of Aleppo.

exposed, as short time as possible, to the influence of the infection, whereby the disease will be daily *contracted* within narrower bounds, until at length the infection be totally *extinguished*.

I am sensible an objection may, at first sight, be made, to thus collecting together the *worst* patients, and as it were *concentrating* the infection in a small spot, where, from the morbid emanations, it may be supposed to acquire the utmost degree of virulence. But we by no means recommend *crowding* together infected patients, on the contrary, they should always be put in large and well-aired apartments, where they can have every convenience that conduces to cleanliness. The wards in *Haslar* hospital are about sixty feet long, twenty-three broad, and twelve high; each of these we find can contain twenty infected patients with ease; and if proper attention be paid to cleanliness, and keeping up a constant circulation of air, not the least inconvenience arises from their number. *Noisome* smells, *mortifications*, and general *putrefaction* are looked upon by many as the certain consequences of an infectious fever; but such must have received this idea from *crowded* hospitals, where foul air and want of clean-

cleanliness, rendered it impossible to judge either of the effect of medicines, or of the true symptoms of the disease. The peculiar *smell* of such patients does not diffuse itself far, and, even in the most malignant fevers, I never perceived any offensive smell from our wards, unless there had been some neglect with respect to cleanliness, or confining the air. The supposed *mortifications* * are only rare occurrences, and are not more frequent in the jail distemper, than in other fevers.

In order to reduce this general plan to practice, it may be proper to add the *regulations* I made for suppressing an infection, some years ago, in a *Russian* fleet, which wintered at *Spithead*. They are here given as applied to the *Russians*.

* The jail distemper itself never produces any disposition to mortification: the spots or *Petechiæ*; however livid they may sometimes appear, never mortify; nor did I ever observe even the strongest blisters to have that tendency, unless just at the approach of death, accompanied with hiccup, convulsions; subfultus tendinum, &c. when it appeared to be rather the effect of exhausted nature, than any genuine symptom of the disease. Mortifications may also sometimes happen, in such fevers, to weak patients, from lying long on their backs; or, in winter, from having their toes frost-bitten, both which cases I have known sometimes to occur.

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though they have been repeatedly confirmed by instances of infection from our own fleet.

Towards the end of the year 1769, a *Russian* fleet, bound to the *Mediterranean*, stopt at *Spithead*. Being very sickly, I was ordered by the admiralty to examine into the condition of their sick, and was of opinion they had got an infectious fever. But before my report was received, the *Russian* ambassador had obtained an order for sending them to *Haslar* hospital. I immediately acquainted the *Russian* admiral with the danger to be apprehended, from promiscuously crowding together a great number of sick in an hospital, by which it might become one general seminary of contagion; and presented him with the following proposed plan of *regulations* for landing and managing the sick. In the execution of these, the admiral, on his part, was pleased to promise every assistance in his power, and ordered them immediately to be translated into the *Russian* language.

I. The hospital can receive a thousand sick in fevers, and three or four hundred surgery patients from the *Russian* fleet, besides the *English* patients already in it; but if at any time the *Russian* patients

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should

should exceed that number, it would be proper to apply for the use of one or two old *hulks* * in the harbour, (which might contain four or five hundred men each), to serve both as a secure asylum for recovering patients, and for the reception of such sick and disabled seamen as have no infection, while the hospital is reserved solely for *infected* patients. - In order not to *crowd* the hospital, it is also necessary strictly to observe, that no *slight* cases be sent, and to detect such as *feign* illness with a view to get on shore, a practice very common on such occasions.

II. In order to guard the hospital against infection, a quantity of *cloathing* should be sent on shore, so that each man sent to the hospital may have a complete suit of cloaths and linen ready for him; every article of which is to be *clean*, and, if possible, *new* †. The cloaths in which the sick are landed, will be either fumigated and returned, or be destroyed, as the officer shall direct, but are never more

* Decayed ships of war employed to receive the crews of other ships when refitting in the dock.

† A request easily granted, as her imperial majesty cloathes her seamen, and many bales of new cloathing were then on board of the fleet.

to be used while the patients remain in the hospital.

III. The *worst* patients should be sent ashore first, and should never exceed twenty in a boat, nor sixty in one day * : with each should be sent a *sick-ticket*, or note, expressing the nature of the disorder, and in particular distinguishing those who have *fevers*, from those who labour under other diseases, or have *chirurgical* complaints.

IV. Every patient, on his admission, is immediately to be carried to the *bathing room*, and to be well *washed* and *cleaned*, then to have a *dress* given him, and to be conveyed to his ward. *Infected* patients will receive the common *house* dresses, which, by the rules of the hospital, are obliged to be worn as long as they remain in fever wards. *Surgery* patients, and those who have *chronic* disorders, from whence there can be no danger of infection, will immediately receive the

* Sixty patients may appear a small number to be received into the hospital in a day, but the operations these patients underwent in being washed and cleaned, the fitting up and airing of boards, with the providing of nurses and necessaries for their immediate reception, gave sufficient employment to the few attendants allowed to the hospital in times of profound peace, when not prepared for such a sudden emergency.

new cloaths sent ashore from the fleet. In the bathing room, also, the *hair* of such as are dirty should be cut off.

V. Patients in *fevers*, who *cannot* rise out of bed, or sit up the greatest part of the day, should be put into *fever* wards: those who complain only of *slight* sickness and shiverings, and *can* remain out of bed the greatest part of the day, should be put into *receiving* wards, till such times as the fever is either entirely removed or more confirmed, when they will be removed, either into the *recovery* or *fever* wards. *Surgery* patients, and those who have the *scurvy*, *consumption*, or other *chronic* complaint, should be put into wards appropriated to their *respective* disorders.

VI. A Russian *petty officer* is to superintend the *fever* and *receiving* wards, and to place *centinels*, so as to prevent any persons going into them, except the necessary attendants of the sick. The *centinels* are also to observe that no chests, bundles, linen, or apparel of any kind, except the immediate dresses of the ward, be carried either into them or the nurse's apartments adjoining, and to suffer no victuals to be *dressed* in the wards.

VII. The greatest attention should be given to *cleanliness* in the sick wards. No patient is to spread any part of his cloaths upon his bed, to wear any part of them in bed, or even to lie down above the bed with his cloaths on: all *foul* linen should be removed as soon as possible, and a free *circulation* of air be constantly kept up, both night and day, by having two windows open, in opposite directions, and at a distance from each other, regulated in such a manner as always to procure a current of air, through the whole ward, just sufficient to move the flame of a candle, so that a person upon entering it may not be sensible of the least disagreeable warmth or smell.

VIII. In the *fever* wards a vessel with *camphorated vinegar*, warmed to a degree of heat a little below that of boiling, should be kept constantly on the table, and the wards be every night and morning *fumigated* with *gunpowder*; before the fumigation, all the windows should be shut, and should not afterwards be opened till the smoke is found inconvenient to the patients. All *dying* and *offensive* patients should be moved, in their beds, to the furthest part of the ward, the adjoining windows should be thrown open, and
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cascarilla bark be constantly kept burning in a pan near them.

IX. The patients, as they recover, are daily to be *drafted* from the *fever* and *receiving* wards into *recovery* wards, leaving the *house* dresses behind them, and putting on a suit of the new cloaths sent ashore from the fleet. But if any should happen to relapse in the *recovery* wards, they are immediately to be *returned* to a *fever* ward.

X. Each *fever* ward is always to be kept *full*, and, as the men recover, its number is to be completed from those who relapse, or may be sent ashore from the fleet; but as the sickness abates, some of the *fever* wards should be daily shut up, and the sick *carried*, in their beds, to the remaining ones.

XI. Every ward, immediately when emptied, is to be *fumigated* by means of *brimstone* and *charcoal* fires, together with all its bedding, furniture and utensils, so that the infection may be *totally* destroyed.

These regulations were executed in their full extent, and it was surprising to see how much the men were refreshed by the change of air, warm beds, and clean linen; and how many of them were, in a
few

few days, able to get out of bed, though when first landed, they appeared to be extremely ill *. By the quick removal of re-

* Our medical treatment of the Russian patients was as follows: the patients, immediately upon being brought from the *bathing-room*, were put into a warm bed, and had each of them five grains of *camphire* given every six hours, with *vinegar whey*. When the fever was attended with a purging, the *camphire* was omitted, and two spoonfuls of an astringent mixture, containing about a quarter of a grain of *opium* in each dose, was given after every griping stool. When attended with costiveness, a quarter of a grain of *tartar emetic* was taken every six hours; and, if its operation was violent, it was checked by the above-mentioned mixture for the purging. A quantity of a *pectoral* medicine was also sent into the wards for such as had coughs. Next morning, all who had the least pain or heaviness of the head, were *blistered*; and by the effects of *blisters* on the men from different ships, we were enabled to judge of the virulence of the infection on board each: when the patients were not relieved by blisters, the infection was always strong; whereas, on the contrary, when the fever was entirely removed, as usual in eight cases out of ten, the source of infection was far more mild.

The effects of *blisters* in distinguishing the virulence of the infection not only appeared in the *Russian* patients, but was afterwards confirmed among the *English*. During an equipment, towards the latter end of the year 1771, upon the apprehensions of a war with *Spain*, thirty line of battle ships rendezvoused at *Spithead*, several of whom had an infection on board. The men from some of these infected ships, I observed, received immediate relief from blisters, whereas, in patients from a few other ships, the blisters frequently did not *rise* and seldom removed the fever. Many of the men from these

covered

covered patients from the sick wards, the number of the infected daily diminished. In the beginning there were eighteen *fever* wards full of patients at the same time, and though more sick were continually poured in, yet these means proved so successful, that two or three wards were emptied every week; in less than three weeks there were only four fever wards, and in a short time two wards were sufficient to contain all the fever patients from the fleet.

Upon a computation I found, that the *whole* number of men contained in the *Russian* fleet was 4200, of these 1521 were sent to the hospital, and 118 died. Of the 118 who died, thirty-two were *consumptive*, had large *ulcers*, &c. The remaining eighty-six died of the *fever*, forty of whom were past all hopes of recovery before they were landed, and some even died in the boats while bringing on shore.

The fleet, when it sailed to the *Mediterranean*, left *England* in perfect health,

last ships died, and the infection was so strong, particularly in one of them, as to resist, for several months, every means of purification that could be made use of, without removing the men, and purifying the ship in the dock.

and continued tolerably healthy for a long time afterwards.

Persons, not conversant with infectious fevers, would find it very *difficult*, in cases of infection, to distinguish the *infected* from such as are only weak, or have other complaints. I have often found patients from infected ships walking about in their chambers, with scarce any other complaint than a slight head-ach and cough, and who have given distinct answers to all my questions ; yet have been informed by the attendants that they were at times delirious, and upon examining the skin, have found it covered with *petechiæ*, which, with the subsequent symptoms, fully proved the malignity of the fever.

Pure air is an article of great consequence in all fevers, but more particularly in those of an infectious kind. When the wards of an hospital are loaded with furniture, it is impossible to keep them perfectly clean and free from disagreeable smells. I have often been sensible, on entering a ward, of even a bundle of cloaths concealed under a bed, and it is surprising to find how soon the scent vanishes, after a very small parcel is removed. Even a single person in a fever can never breathe a pure air, whatsoever

foever attention be paid to cleanliness, while he is confined in a chamber crowded with furniture, with curtains both to bed and windows, with a carpet, chests of draws, &c. which serve as numerous receptacles for retaining the infection: in such a situation, the air must be tainted. However seemingly trifling these matters may appear to the ignorant, yet in cases of infection they become of the highest consequence.

F I N I S.

ERRATA.

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|--------|---------------------------|---|
| Page | 1. Line 17. | for ifection, read infection. |
| 3. | 13. | dele always. |
| 8. | 9. | after Chap. II. add Sect. V. Of Dissertation
on Fevers and Infection. |
| 17—22. | Running Title. | for Of Draughting men, read
Diseases in Northern Climates. |
| 31. | Ult. | for Practioners, read Practitioners. |
| 34. | 18. | dele before and. |
| 103. | 8. | for Cooksworthy, read Cookworthy. |
| 106. | 21. | of Note, for Plymouth yard, read Portf-
mouth yard. |
| | 24. | of Note, for J. Cauldfield, read T. Caulfield. |
| 129. | 18. | after is not only, add often. |
| 142. | Running Title of Chapter. | for Preservations against
Infections, read Preservatives against
Infection. |
| 171. | 3. | for or, read from. |
| 172. | 6. | for Lientary, read Lientery. |
| 174. | Antepenult. | after Unc: ij. add ad. |
| 200. | 4. | of Note, dele it. |
| 261. | 26. | for Facility, read Faculty. |
| 265. | Ult. | for mental, read mortal. |
| 282. | 4. | of Note, for Venenam, read Venenum. |
| 6. | Penult. | for Cofntry, read County. |